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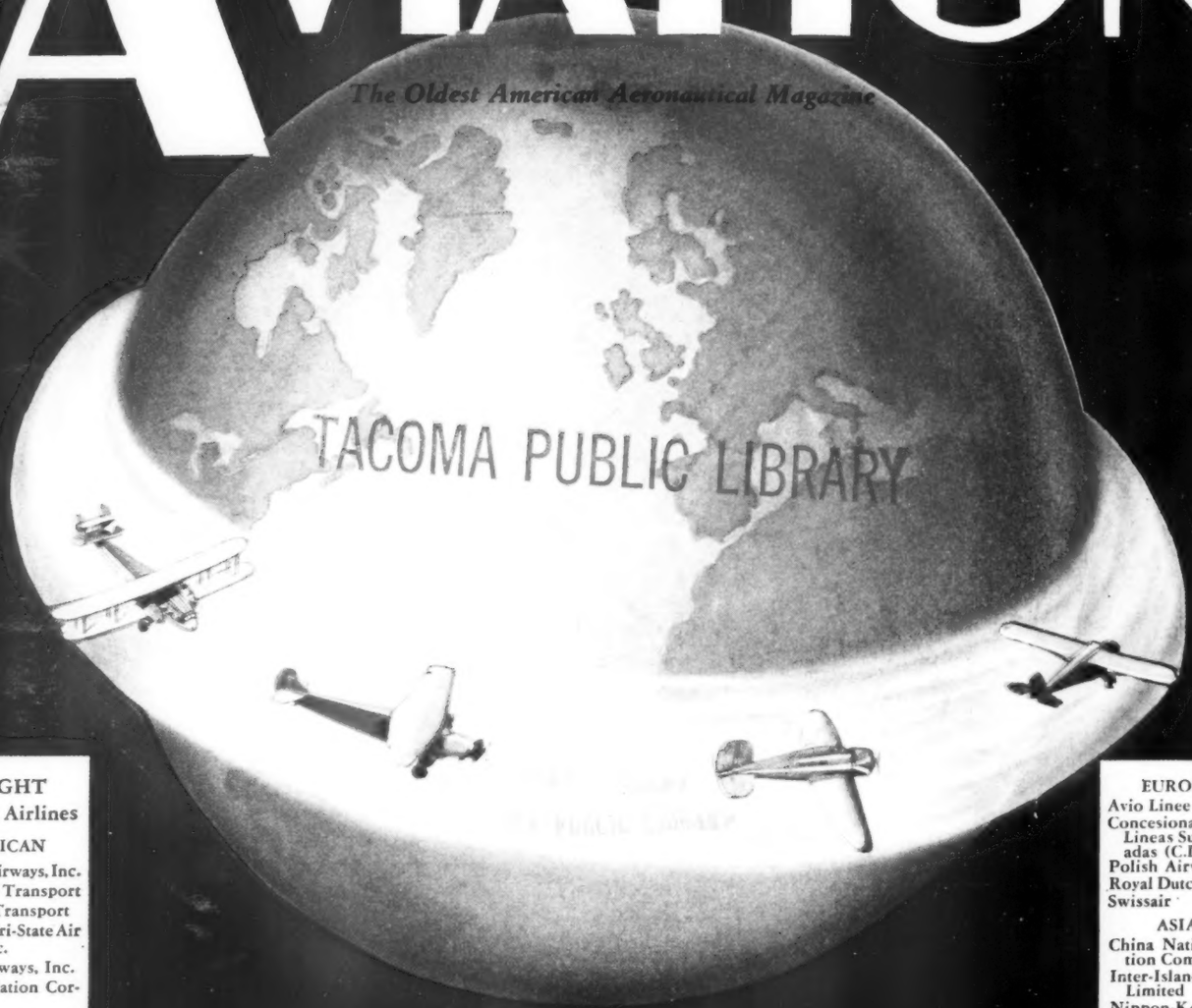
AVIATION

The Oldest American Aeronautical Magazine



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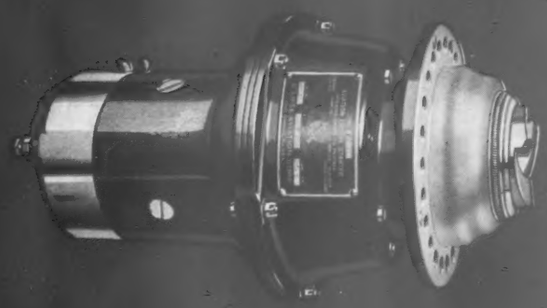

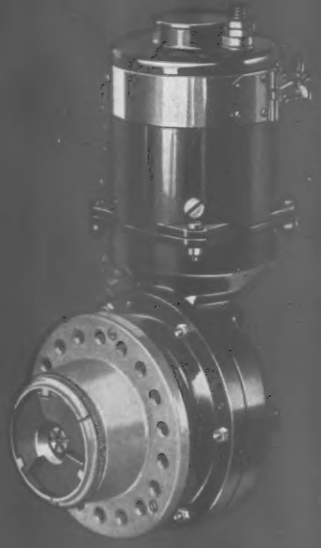

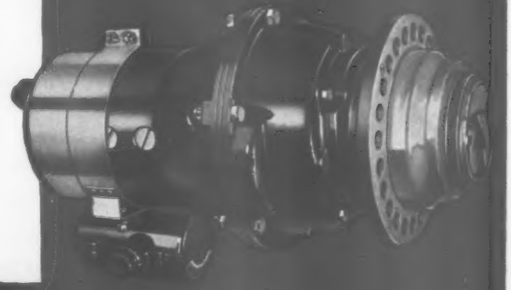

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AVIATION

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The Oldest American Aeronautical Magazine

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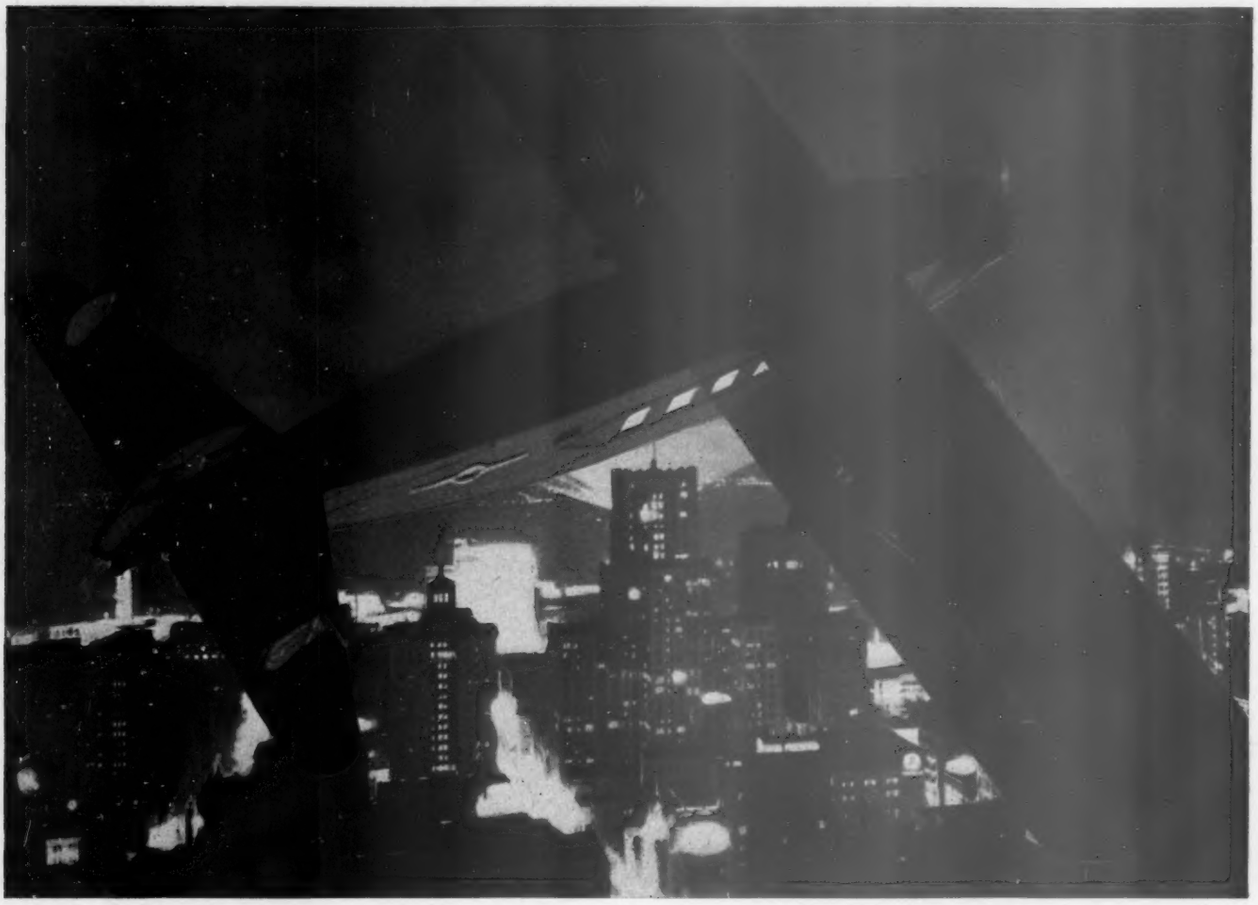

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AVIATION
FOR JULY, 1932

A unified air express service

What it will mean to the aviation industry

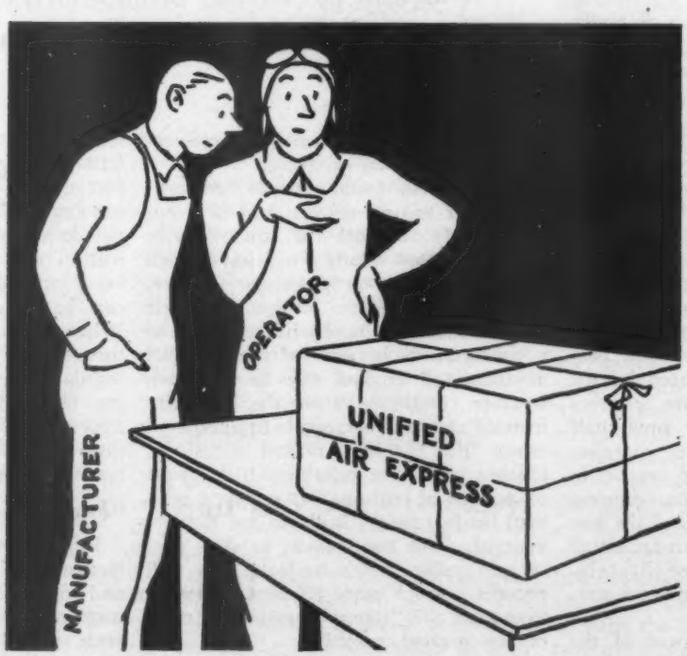
By Monte C. Abrams

ORGANIZED air transport is now in a pioneering period which will probably continue for another five or ten years. Of all its possibilities, air express offers perhaps the most fertile field for further development and expansion. Express matter is generally replaceable, whereas passengers and mail are not. Although records for reliability and regularity of service are even now relatively satisfactory, the need for exercising extreme caution with passenger loads is greatly hampering further essential developments notably night and bad-weather flying. With express alone, however, the carrier can assume certain reasonable additions of risk in connection with flight operations and technical developments. Such a policy may make it practical to extend and intensify air transport operations much more rapidly than might otherwise be done, and many phases of operating technique perfected in connection with express flying may then be applied to the business of carrying passengers.

Aside from its special importance to the rest of the industry, express represents a very desirable type of traffic. Speed requirements are not as high as those of mail and passengers. Flying equipment can be of the most economical type, with no concessions to passenger safety, comfort, or convenience, and the loads will move at such time and in such quantities as efficient operations demand.

Although transport operators have not yet established nation-wide unified express services, it is astonishing to note the rapid gain which has been made recently with this type of traffic. The faults of the present set-up, as outlined in AVIATION for November, 1931, are still uncorrected. The basic fundamentals for an adequate system, laid down in the February, 1932, issue of AVIATION are still unsatisfied, and the major requirement—that a unified air express system must be established to cover the entire United States—is apparently no nearer realization than it was a year ago. In spite of the failure to provide proper services, however, the rapidly increasing express loads that the airlines are now handling support the conclusion presented by the author in AVIATION for December, 1931, that a much greater volume

WHY NOT FIND OUT WHAT'S IN IT?



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of air express traffic is available than has been generally realized. All evidence indicates that the growth may be very greatly accelerated through the provision of a unified service.

Potential traffic

This article will outline some of the benefits that would accrue to the aviation industry as a result of handling the volume of air express traffic that a properly developed unified service would generate. The author has previously advanced his theory, based on a series of surveys, that a proper service would develop an air express traffic at least equal to 5 per cent of the present rail express traffic, to be carried at a tariff approximately three times present rail express rates. On this basis the total annual express traffic for the country might amount to some 300,000,000 lb., with an annual gross income for the carriers of approximately $22,000,000. These figures are conservative, and are presented merely as a means of visualizing the possible place of air express in the air transport picture of the near future.

Taking an even more conservative estimate of the possible volume of express traffic to be developed by a unified service, the editor of AVIATION stated in the "Aviation Platform" (AVIATION, February, 1932) "We believe that the present volume of air express traffic can be multiplied by at least fifty and perhaps by a hundred or more, within the next few years, but it can only be done through a centralized and completely impartial operating organization." Assuming that present traffic is to be multiplied a hundredfold, the prospective volume would be approximately 90,000,000 lb., or about 12,000,000 ton-miles per year. Estimating gross income on this volume of traffic at the low rate of 30 cents per ton-mile (which it is already anticipated might be established) annual gross income would be at least $3,600,000. Even this very low figure is more than half the total income of the operators in 1931 from passenger-carrying operations.

It is quite evident on the basis of the above figures that actual operations in point of total traffic handled might more than double the present passenger transport loads in which case new income would be equivalent to more than half of present total income from passenger carrying. It is estimated that the additional cost of providing express service would probably not equal half the present cost of passenger carrying operations. There is every reason to believe that the income from express traffic, even if it did not exceed the low figure quoted, would represent an actual profit on the operation, materially helping present deficits resulting from passenger operations.

It is possible that the lower of the figures quoted above is materially below that which would be actually realized, and that the true income from express traffic might be more nearly $22,000,000, or more than three times the present total passenger income. In any case, express traffic on the ton-mile basis may exceed the present total passenger traffic when a unified system is properly established. Since this traffic will probably be carried in new equipment specially built for the purpose, express operations as outlined may at least equal the present activity in passenger carrying. Total air transport activities —except the carrying of mail—might be at least doubled.

Operators and manufacturers

Consider separately the two general divisions of the aviation industry to be most affected by volume air express development; the air transport operators, and the aircraft manufacturers. Evaluate also the influence of the development of express traffic from two viewpoints: first, benefits to the industry commercially, and second, benefits in connection with technical progress.

Air express traffic is not temperamental; it has no nerves, and it is not particularly critical of the service rendered. Bad weather will have much less effect than on passenger service, for obvious reasons. Shippers of air express loads will rarely hesitate to send a consignment because of the prospect of increased hazard due to unknown weather conditions, since the loads are insured and are replaceable in almost all cases. For the same reason, occasional crashes will have relatively little effect on volume of business. In common with mail loads, express loads do not flutuate violently with the seasons as does passenger traffic. This uniform flow will present a much more efficient operation than does the "jumpy" passenger traffic of the present period.

Again, air express traffic, once developed on a large scale, becomes "automatic," or self-perpetuating, to a much greater degree than does passenger traffic. Passenger traffic at the present time is subject to whims and fancies. It is hard to get and hard to keep for a variety of reasons. A first-timer, if bothered by noise or cold, if air-sick, or if frightened, may not patronize air transport for a long time again, if ever, and may discourage travel on the part of others. Air express traffic, on the other hand, should continue at a fairly uniform rate when once established.

This development of a new class of traffic on a large scale should do as much to sell the use of all air transport facilities to the public as anything that has been done to date. The air mail service has done much to encourage passenger travel by air. The chief value of the air mail service, however, has been in the provision of flying service and facilities of which passengers could take advantage. The actual value of letter mail by air as a sales agent of air travel may be considered slight. A letter is a light thing of little bulk. The fact that it has been carried by air is not impressive. It is doubtful if many people are moved to consider the proposition that because a 1-oz. letter has been carried by air they, themselves, can be flown safely and in comfort. When package after package comes through by air; when business men regularly receive air shipments weighing hundreds of pounds and of very appreciable bulk, people may be influenced to undertake the use of air transport for their own personal travel.

"Farewell, Romance!"

Furthermore, there is no romance attached to air express activities. It is, and will probably always remain, a very matter-of-fact sort of an enterprise. As such, it is bound to exude an atomosphere of stability that will do much

¶ In three previous articles, published in recent issues of AVIATION, Mr. Abrams has outlined his idea of a perfect air express business and of its great possibilities in promoting the welfare of air transport companies. In the present article he summarizes the arguments for such a service, the conditions under which it ought to function, and the grounds of his conviction that an enormous volume of express shipments can be attracted into the air. Mr. Abrams has a great deal to say to transport operators, but his observations will be equally serviceable to the aircraft manufacturers. He calls for a type of equipment that does not now exist in the United States

to impress the lay public with the fact that avation is now no longer a side-show or an adventure. Probably nothing that could be done would do as much to dispel this unhealthy glamour which now surrounds air transport operations as would the wholesale transportation by air of great volumes of merchandise, dry goods, flowers, machinery, periodicals and newspapers, vegetables, fish, auto supplies, and other every-day commodities. If air transportation is so prosaic that all sorts of heavy express loads are reguarly carried, it cannot be too much of an adventure for an ordinary individual to undertake.

Widespread development of air express should also serve to increase air mail loads. In order to maintain close control the majority of air express shipments will no doubt be accompanied by bills of lading, notices of shipment, or letters of instruction sent forward by air mail. In general, all correspondence relating to air express shipments, prospective or otherwise, would be carried on by air mail. While it is not easy, nor necessary to predict just how the Congress and Post Office Department will arrange to eliminate the gap between air mail and first class mail, it is probable that the provision of load carrying capacity at relatively low rates will bring beneficial action earlier than might otherwise be effected. When a system is set up which will carry loads at 30 cents per ton-mile and provide fast and frequent service to the entire country it is only logical to suppose that the government will arrange to make use of it on a large scale for mail carrying. The establishment of a unified express system should act as a powerful stimulant to the "mail by air" trend.

Filling out the skeleton

The most material advantage to be found in the development of volume air traffic would be in filling out the present skeleton of an air transport industry and pumping vitalizing life blood into its circulatory system. Air express operations can dovetail beautifully into the present air transport set-up. The same routes and terminals may be used; the same communications and dispatching systems; the same radio beacons and other navigation aids; the same shop and terminal personnel;—and the same operating executives and general operating and overhead machinery might serve the air express operations as now function chiefly for mail and passenger services. Since it is proposed that most of the express be carried in special express planes, whose number is estimated to be about equal to the present number of passenger transports, present operation schedules may be doubled. The doctrine of profitable operation through intensive use of all facilities and equipment, both ground and flying, has been well established. Increased operating intensity brought about by express traffic should make it possible to operate many routes at a profit which do not otherwise show any possibility of profitable operations for a long while to come.

The benefit to general technical development in the aeronautic field, brought about by the needs of a volume air express service, should be enormous. Not only will such developments appertain to the field of express carrying, but they will also apply with material force to all phases of flying.

New designs and construction

In general, it is probable that we will see an entire new field of aircraft construction developed—just as the truck manufacturing field differs materially from that of pleasure car manufacture. As this new equipment is built and tested there should be many opportunities for testing new technique in both manufacture and operation, the results of which may later be applied to other types of aircraft. Accessories and instruments may be tried out in connection with express operations, which could not be experimented with on passenger transport service. No routine or factory testing can ever take the place of actual service operations—yet there are many innovations which operators would hesitate to try out on human cargo, but which may be proved up in connection with express operations. New instruments, fog-flying devices, instrument landing system, television apparatus, etc., may be tried on express and mail planes and after they have proven satisfactory they can then be applied to passenger transport operations.

Not only would the development of air express traffic benefit the aviation industry in the various ways that have been outlined, but it will also have a material affect on the problem of national defense, and upon the development of all commerce and industry in this country. Large cargo planes such as must be developed for transporting air express loads should prove ideal for numerous military uses such as the general freighting of emergency army supplies, troop carriers, aerial ambulances, and even for bombing. Certainly the existence of a large fleet of express carrying airplanes, together with an efficient system for their nation-wide use, will greatly simplify the problem of national defense.

The transportation scheme

Finally, the provision of such an air express service as has been outlined should make it possible for all commerce and industry in this country to reach a new high level of efficiency. In any commerce there are always premium goods, the efficient handling of which vitally affects the distribution of vastly greater quantities of goods. Examples are found in style models of all sorts; samples of grain, and silk, and miscellaneous manufactured products; merchandising displays used to expedite the rapid distribution of certain merchandise; machine parts vital to the maintenance or operation of all sorts of machines; and many other kinds of material and supplies. By speeding the interchange of such premium goods, and through the closest coordination of air express shipping with telephone, telegraph, teletype, cable, radio, or air mail, it should be possible for all commerce and thereby all industry to operate more efficiently. A flow of commerce smoothed out and "elasticized" through the proper development of air transportation, should improve industrial organization. Production and distribution must be geared to the proper ratio, and much of the loss that now occurs between the production and assembly of raw materials and their final consumption might be eliminated.

though it has been the subject of very careful preliminary studies in a number of aircraft engineering departments. ¶ The author's prophecies on the magnitude of air express business may or may not command general agreement, but we believe that almost everyone can accept two of his conclusions, to wit: (1) that the attaining of any very great measure of success for air express will depend upon the establishment of a completely unified handling organization in which all operators participate; and (2) that the specialized express-carrying airplane of large payload capacity and of comparatively moderate speed is worthy of the most serious consideration.

THE UNITED STATES OF AMERICA (PART TWO)

The equipment of air forces

By Edward P. Warner
Editor of AVIATION

OF all brands and species of military flying, pursuit aviation is the one that comes nearest to existing exclusively in the air. The observation pilot must be schooled in the tactics of surface armies and in the characteristics of surface ships, and must plan his whole course with reference to what lies below. The function of the bombing plane is to attack objects, fixed or moving comparatively slowly, upon the surface. Attack aviation and patrol aviation both have missions bearing on surface conditions, but the great function of the pursuit airplane and its pilot is to fight in the air. During the time when pursuit aviation is performing its primary mission it lives in a purely aerial world, and the surface of the earth might as well not exist, except for the occasional necessity of taking anti-aircraft fire into account and operating at an altitude which will keep its hazards within reasonable limits,—and of course for having to reckon with the wind in planning to get back home before the fuel runs out.

It may be for the very reason that it seems the most purely aeronautical of all military activities,—it may be because the human heart thrills to an enterprise in which one man has to stand alone and carry the burden alone,—or it may be because fighting is a good straightforward thing that anybody can understand,—that pursuit flying has a romantic appeal that no other form of military aviation possesses. The great heroes of 1914-18 were the fighting pilots. Small boys, growing up in eager anticipation of the time when they, too, could be a part of the current excitement, dreamed of roving about the sky with ready machine gun. The names of Rickenbacker, Luke, Lufbery, Guynemer, Fonck, Ball, Bishop, Richthofen, and Boelke were by-words even among laymen. If a bombing pilot ever got into one morning's newspapers he was forgotten before the next but the fighters remained as glamorous figures, lone adventurers, the knights in shining armor of the twentieth century.

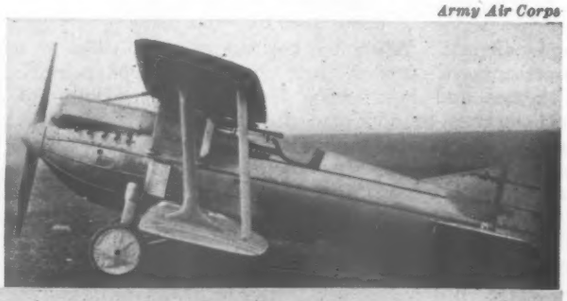
An officer attached to observation, bombardment, or any other type of military aviation except pursuit never is, and never could be, any good unless he knows much of general military operations. Even for the pursuit pilot they are significant, but his task is more concentrated. During the war it was so very concentrated that, like the famous first mate whose captain wanted from him "nothing but silence, and damned little of that," the officer attached to pursuit aviation needed only to know flying and gunnery and close-range combat tactics, and sometimes not such a tremendous lot of flying as skill in flying is ordinarily judged. Some of the most famous of the aces were distinctly mediocre pilots, and there is at least one legandary tale of a man who was so totally unable to learn to fly that his instructors finally became disgusted and sent him off to the front, thinking that he would thereupon cease to worry anybody. He contradicted their calculations by bringing down two German planes on his first flight, whereupon his superiors decided to forgive him his habit of more or less completely wrecking an airplane on every third landing.

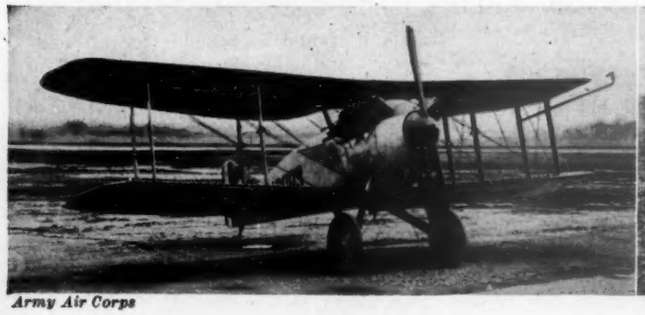
Why "pursuit"?

If the function of the type of operation that we are discussing had to be defined in a single word, "fighting" would be the only one that could be used. Yet only in the United States Navy are the airplanes regularly known as fighters. In almost every other service, including our own Air Corps, they bear names that derive from the original idea, born in the early days of the War, that the business of the type was to use its high

Old-timers. Bottom, left: The Army's MB-3. Bottom, right: The Navy's TS-1. Below: An early adventure in metal construction, the Gallaudet PW-4 of 1923.

Army Air Corps





Army Air Corps

U. S. Navy

Army Air Corps

Army Air Corps

Army Air Corps

Curtiss evolution. Above, left: The PW-8, 1923. Left: An object lesson in cleaning up, the Pulitzer racer of 1922. Above, right: The P-6E, 1931, which boasts a top speed of 195 m.p.h., cools with Prestone, and has a simplified landing gear.

Gull wings on special service. Below: The B-J two-seater, the P-16. Performances are not yet available. Above: The Curtiss XF9CE, which comes home to roost inside the Akron. The first of the type rode the airship on its recent West Coast trip.

U. S. Navy

Army Air Corps

speed in catching up with, and its meager armament in shooting down, observation or other working airplanes which would be totally unarmed. All through the years of 1916 and 1917, when aerial battle was developing on a grand scale and taking the characteristic forms of the individual combat and of the protracted mass mêlée, all the nations concerned clung to a terminology which had nothing to do with fighting, and that had been originated at a time when aerial combat was thought to be either totally impossible or quite unlikely. It still survives.

As a matter of fact, the pursuit airplane seems more accurately named now than it did a dozen years ago. By no stretch of the imagination could a prolonged mêlée, with all the combatants maneuvering on approximately the same level and remaining over a comparatively small area, be described as "pursuit." The tactics that were first created in embryonic form by Richthofen's flying circus in the last eighteen months of the War, and that have since been very highly developed in the United States, fit the name much better. When pursuit airplanes operate in squadrons and when their normal tactic is to dive in formation from superior altitudes onto a group of enemy bombers, or fighters, or whatever they may be, concentrating their attack in one withering blast of fire, they become pursuit ships in very fact.

Post-War pursuit takes a new start

There was no mass production during the War to shackle American pursuit development after 1918 to a dead past. In planning its observation work, the Air Service after the armistice was faced with the fact that there were several thousand DH-4's on hand and that they could not arbitrarily be discarded. Of pursuit airplanes, however, there were almost none, and the development of pursuit equipment could start from scratch.

Sundry efforts had been made to build pursuit machines of various European designs in American factories. None of them turned out well, and all the contracts were cancelled. By subsequent agreement with the Allies we concentrated upon a training and observation program, and our combat forces depended upon European factories to furnish them with Spads, Nieuports, Sopwith Camels, and SE-5's. Our trained pursuit personnel came home after the armistice, full of ideas for the improvement of pursuit equipment and pursuit tactics. They left their airplanes behind, and they found a clean slate on which to write.

In the meantime, however, at least one purely American pursuit airplane had been made ready for trial. The Thomas-Morse MB-3, which was to become the cornerstone of our post-War pursuit activity, was completed and tested just as the war was ending. Showing distinct Spad influence, it was a biplane of low aspect ratio, with wings of equal span. A 300-hp. engine, designed by Hispano and built by Wright, drove it at the then extraordinary speed of 164 m.p.h. After a year or two of discussion, and study of a variety of tentative designs, and after buying 62 MB-3's from Thomas-Morse in 1920, the Army issued invitations to bid on the construction of 200 MB-3A's. The Boeing Company got the business, and the contract is a memorable one. It still stands as the largest order (in number of planes) ever placed in time of peace for military airplanes other than training machines. It was one of the first and most notorious applications of the policy of recognizing no proprietary right in design, but of letting subsequent construction under privately-developed designs out to the lowest bidder,—a policy which naturally occasioned frantic alarm and violent protest from the industry.

The Boeing factory has remained in production on pursuit machines ever since, but since that time it has always been the Boeing Company's own designs that have kept it busy. The MB-3's, built at Seattle, remained the standard pursuit type of the Air Corps until 1923 and were used in the first race for the John L. Mitchel pursuit trophy, competed for by the First Pursuit Group at Detroit in 1922.

The Army also bought several monoplanes between 1921 and 1922, mostly from Thomas-Morse and Loening. One of them put under trial at about that time made a name for its pilot by enrolling him as the first member of the

Caterpillar Club after aileron flutter had disintegrated the wings of the plane. A whole series of alarming experiences with flutter, then a little-understood phenomenon, was in fact largely responsible for the virtual elimination of monoplanes from consideration. The lineage of the modern pursuit ship traces most directly from the PW-1 biplane, designed and built at McCook Field in 1921. In general appearance it showed a close similarity to most of the standard pursuit planes delivered to the Army and Navy in the last eight years, except that it was much less clean in form around the nose of the fuselage than its successors have become.

The symbol PW-1, with the other PW's that went before it, is worthy of note. It is a reminder of the extent to which the needs of the air service were supposed to be diversified in the years immediately following the war. Between 1919 and 1922 specifications were issued and orders were placed for no less than six distinct types,—high-altitude water-cooled pursuit, air-cooled pursuit, ground (or low-altitude) pursuit, night pursuit, two-seater pursuit, and "alerte." The first five are self-explanatory. The sixth was a light machine, for very quick take-off and climb up to the zone of combat as soon as the approach of enemy bombers should be signalled. It corresponded to what the British have since called a "home defence scout," or to what the French now describe as "appareil jockey."

Racing takes a hand

The status which American pursuit aviation had reached by 1925 was a complex of two sets of influences. One of them was represented by the development through the MB-3 to the PW-1, the result of direct service experience and of analysis and criticism by veteran pursuit pilots. The other influence was furnished by the Pulitzer races.

The first attempt at a super-speed military plane in the United States had been the Curtiss-Kirkham triplane, built in 1918, and mounting the first of the high-powered twelve-cylinder Curtiss engines.

In 1919 the Air Corps began to take a very definite interest in racing and backed an entry, which had but little success, in the Gordon Bennett Airplane Race in France in 1920. In 1921, Admiral W. A. Moffett became chief of the Navy Bureau of Aeronautics, and immediately manifested his impatience with any theory that naval aviation should be limited to flying boats and low-powered seaplanes. His demand for more and more speed in naval aircraft, and his enthusiasm for racing as a means of encouraging the development of speed, were positive and unremitting. In both services, "the racing plane of today is the fighting plane of tomorrow" became a much-used slogan. In 1919, almost all the emphasis had been laid on maneuverability. By 1922, it began to shift to speed.

The autumn of 1922 found both services with fully-developed racing programs, and competing against each other for the Pulitzer trophy at Detroit. No less than fifteen machines started in that race, and all of them were Army or Navy entrants. The Army alone entered the products of five different factories.

The winner of the 1922 Pulitzer, as of every Pulitzer race thereafter except one, was a Curtiss biplane, and the case of the biplane as a pursuit type was strengthened accordingly. In 1922 the process of cleaning up the structure had already been carried very nearly to the limit of possibility. Although the Curtiss machine that won the 1925 race exceeded the 1922 winner by 43 m.p.h., most of the improvement was due to increase in horsepower. The greatest of all aerodynamic innovations was made in 1922, when wing-surface radiators were first applied. The speed was immediately stepped up about 20 m.p.h., and plans were at once made for incorporating the new feature in standard pursuit equipment,—in sublime confidence that some scheme would sooner or later turn up for overcoming the obvious vulnerability to machine-gun fire of the wing radiator and its equally appalling maintenance characteristics and tendency to develop leaks in service. No scheme has turned up yet, and the wing radiator's life in pursuit use was short. It was practically limited, in fact, to the PW-8, which was offered to the Army by the Curtiss Company in 1922, and became the successor of the MB-3 Pursuit Group. It was a two-bay biplane with wings of equal span, and showed a speed of 178 m.p.h. and a service ceiling of 24,000 ft.

Sesquiplanes triumphant

The next step was the introduction of the wing arrangement which has been almost standard throughout the last seven years,—a sesquiplane with tapered wings and with a single inter-plane strut on each side of the fuselage. The Boeing Company brought out the first of that school in the PW-9 in 1923, the first of the notable Boeing contributions to pursuit design; Curtiss quickly followed with the PW-8B. The major difference in the general form of the machines, and it is a difference that has on the whole persisted in all subsequent Curtiss and Boeing products, was that the Curtiss design had a heavy stagger, while the Boeing had none.

Although the sesquiplane still rules the field, there has been an almost steady reduction in the amount of overhang. The same machines have in many cases been offered both for Army use and for service on board the aircraft carriers, and in carrier duty deck space is of such value that every possible effort is made to reduce the extreme span. Reducing the inequality of area in the wings of a sesquiplane is one obvious means of taking something off the span of the upper wing, and it has been done.

The Boeing PW-9 succeeded the Curtiss PW-8 as standard pursuit equipment in 1925, and remained in the leading position until 1929. Since then the pendulum has swung between Curtiss, with P-1C's and P-6's, and P-6E's, and Boeing, with P-12's and P-12E's in various minor modifications. The general evolution has been towards increasing compactness of design; towards the use of deeper and shorter fuselages; lighter structures, with duralumin-tube fuselages replacing welded steel; and more careful shaping of the nose of the

Fighters—power, poundage, and performance

ARMY Plane	Date	Gross weight (pounds)	Useful load (pounds)	Engine	Horsepower	Maximum speed at 10,000 ft. (m.p.h.)	Service ceiling (feet)	Time to climb to 20,000 ft. (minutes)	Cruising endurance at 20,000 ft. including time in climb (hr.-min.)
MB-3	1920	2094	588	Hispano Suiza	300	144.0	23,700	21:0	3:00
PW-8	1923	3151	960	Curtiss D-12	440	159.2	20,350	30:6	2:45
PW-9	1924	3015	963	Curtiss D-12	448	156.3	21,000	33:7	4:30
P-1	1926	2846	788	Curtiss D-12	449.5	98.3	22,500	24:0	5:30
P-6A	1928	3172	783	Curtiss V-1570A	600	173.5	27,200	15:3	3:40
P-6E	1931	3392	693	Curtiss V-1570C	600	189.5	24,700	16:0	4:00
P-12	1929	2536	778	P & W Wasp	450[1]	166.0	28,200	15:5	4:20
P-12E	1931	2690	691	P & W Wasp	500[3]	187.0	26,300	14:8	4:30

NAVY Plane	Date	Gross weight (pounds)	Useful load (pounds)	Engine	Horsepower	Maximum speed at 10,000 ft. (m.p.h.)	Service ceiling (feet)	Time to climb to 20,000 ft (minutes)	Cruising endurance (hr.-min.)
TS-1	1923	1920	680	Wright J-4	200	117.0	16,250	....	7:30
F6C-4	1926	2714	750	P & W Wasp	425	149.0	22,900	19.2	3:45
F7C-1	1927	2782	744	P & W Wasp	450	146.0	23,350	21.8	3:30
F2B-1	1926	2874	816	P & W Wasp	450	151.0	21,500	27.8	3:25
F3B-1	1928	2950	767	P & W Wasp	450	149.0	20,900	33.0	3:30
F4B-1	1929	2716	890	P & W Wasp	450[3]	162.0	26,400	17.7	3:20[5]
F8C-4	1931	3783	1270	P & W Wasp	450[3]	143.0	19,800	....	4:40[5]
XF9C-1[4]	1932	2474	659	Wright R-975C	400	160.0	22,600	22.5	3:10

[1]Endurance given at sea-level for most navy types. [2]Essentially like the Army's P-12. [3]Supercharged engines. [4]This is the miniature fighter to be carried on the Akron. [5]At 6,000 ft.

U. S. Navy

Army Air Corps

Army Air Corps

Boeing-built pursuits. Above, left: The PW-9, long the Army standard. Right: The P-12E, the latest Boeing service type. Above, right: The first Seattle-built pursuit monoplane,—XF5B1.

fuselage on the planes with liquid-cooled engines, in order that effective radiator resistance might be reduced to a minimum. There have been no more wing radiators on service planes since the PW-8, but on such machines as the Curtiss P-6E of 1930 the radiator is so carefully set into the lower surface of the fuselage that the added resistance is very small. The growing availability of prestone for cooling, first regularly adopted with the P-6E, has of course simplified the radiator resistance problems.

The Navy sets to work

Pursuit was an Army problem long before the building of fighting planes had begun to disturb the Navy seriously. Nevertheless, naval activity in the field was quite independent of the Army's work, and it was only after several years of independent development that the two services began to draw together on their equipment. The fact that they were racing against each other with practically identical planes built in the same factory no doubt played a large part in finally bringing them to a community of view of what a fast fighting craft needs.

The first Navy fighter was the TS-1, an odd-looking biplane developed in the Naval Aircraft Factory, unusual in its use of a Warren truss and in carrying the lower wing across below the fuselage in accordance with the practice first introduced in the British Bristol fighter, and equipped with the first of the Whirlwind engines to go into service. The TS-1 was good for only about 125 m.p.h., but it served admirably as the "dog" on which experiments could be tried while air fighting tactics were being developed in special reference to naval requirements. The original plan of course was to mount the machine on floats, but it did its first work as as a seaplane, but it went onto the carrier Langley as soon as that vessel was commissioned.

The fighter based on a catapult, and the fighter operating as a seaplane from a base in sheltered waters, have largely disappeared from the naval picture. Fighting development as the naval air arm now knows it is exclusively connected with the aircraft carriers, two squadrons of fighters being based on the Lexington and the same number on the Saratoga at present. The technique of flying from carriers has been carried to a point where it now imposes astonishingly few restrictions on the design of the airplanes used, but it is still necessary to have some regard to its special features, and in 1926 and thereabout they played a large part. The forward vision from a carrier plane must be exceptionally good. Hence there is general insistence on an adjustable pilot's seat, that can quickly be raised by several inches when coming in to land. The landing gear must be exceptionally rugged, and the landing speed must be within reason.

The first definite statement of specifications for carrier fighters was issued by the Navy in 1926, when a competition for the type was held. Several machines were submitted, but the only one that presented any elements of striking novelty was a Curtiss, the F-7C1. It was a biplane, differing from the Army Hawks in having wings of equal span.

The competition had but little lasting effect. The Navy's fighting development continued the even tenor that had already been established before it was announced. As early as 1925 there had been a number of purchases of Curtiss Hawks, built to the general design developed for the Army, but fitted with floats. By 1927 the determined policy of the Bureau of Aeronautics, to insist on air-cooled engines for all purposes, had become the controlling factor in the fighter field, and both Curtiss and Boeing had modified their Army design by installing Wasp engines.

A series of Curtiss and Boeing designs followed each other onto the carrier decks. The most striking innovation appeared in 1929 with the delivery of the Boeing F-4B-1, which showed up almost the same time in the Air Corps under the designation P-12. It was the first modern pursuit airplane to be engineered from the ground up around an air-cooled engine. The F-4B still form the backbone of the equipment of the Navy's fighting squadrons, with 80 of them in the service at the present time and 60 more on order.

What governs design?

Our description of pursuit and fighter evolution from 1920 to 1930 has so far related to features that would be apparent in the most superficial examination. It is time now to go back and look a little farther beneath the surface.

It has already been remarked that the increase of 40 m.p.h. in racing speed between 1922 and 1925 was due principally to increase of power. The same cause brought about most of the improvement of pursuit performance between 1923 and 1930, as is apparent from the table at the bottom of this page. While military equipment was being steadily increased in variety and in weight,—while the load factors and the structures were being periodically raised,—while the gross weight of a typical single-seater fighter went up some 50 per cent,—there was a gain of about 50 m.p.h. in maximum speed, and the service ceiling remained substantially unchanged. Increase of power did the trick,—an increase of from 300 to 600 hp. in liquid-cooled engines, coupled with the production of an air-cooled engine which gave 20 per cent more power in 1931 than had been obtained from the water-cooled pursuit engine in 1923. The gradual acceptance of higher landing speeds also played a part.

At the end of the war American pursuit airplanes were being built for a maximum load factor of 8.5, the same figure as was then,—and still is,—used in Great Britain. American pilots were seemingly more insistent on violent recoveries than those of the Royal

Air Force, for about 1923 structural troubles began to occur with alarming frequency, culminating in the structural failure of two of the machines entered in the 1924 Pulitzer race. Load factors were increased as a result, first by the Army and subsequently by the Navy, and are now about 50 per cent higher than they were a dozen years ago. The need for increased factors was of course accentuated by the introduction of diving tactics. When the pursuit group subordinated individual combat in favor of diving on the enemy force in large formations, and when the Navy took to dive bombing, it became necessary not only to increase the load factors on the wing but to stiffen up every element of the structure. The metal tail surfaces on the P-12 are one particular manifestation of the general tendency of structural design of 1927-29.

Back seats for pursuit planes

In all that has been said so far pursuit machines have been discussed as though they were inevitably single-seaters. In practice that has usually been the case, but the two-seater fighter is neither unknown nor extinct.

The British forces were particularly impressed with the possibilities of two-seater pursuit during the latter years of the war, and developed the Bristol Fighter, later more generally used as an observation plane, for that service. The first Loening monoplane to be delivered to the Army, completed during the summer of 1918, was a two-seater pursuit. The next attempt to construct to the specifications was made in 1923, when the TP-1 was designed and built at McCook Field. The TP-1 was the work of Messrs. Boulton and Kerber, now of the engineering staff at the Glenn L. Martin plant and president of the Spartan Company, respectively. It showed excellent performance, but it was dropped cold as the result of the decision to abandon "official design" and to depend exclusively on the industry thenceforth.

Within the past two years the two-seater has begun to come back, both in the Army and in the Navy. In the Army its re-appearance has been in the shape of the P-16, a Berliner-Joyce production with Curtiss Conqueror engine. Twenty-five of them have been ordered by the Army Air Corps for service test. In the Navy there was a marked change in tactical doctrines during 1927 and 1928, and the two-seater fighter and specialized dive bomber were the principal beneficiaries. The Vought Corsair had been so impressive in its first year of service that it seemed to various officers taking a prominent part in the development of service equipment that it should be possible to develop the two-seater fighter with performance very little inferior to that of the best single-seater fighters then in use. The Curtiss Company got the contract, and of the resultant machine, closely similar to the Helldiver observation plane in general appearance, 28 were ordered betwen 1928 and 1930. The Berliner-Joyce and the Curtiss planes are all biplanes of more or less normal form. New two-seater fighters, expected to give considerably higher performance than any of their predecessors, are now under development.

The Berliner-Joyce company is connected with another important innovation. Temple N. Joyce was a pursuit pilot in France, and during his experience there he acquired strong conviction on the subject of interruption of the pilot's visual arc by the upper wing of a biplane. His feelings lost nothing in warmth with the passage of time, and in the P-16 he finally found a chance to do something about it, for the P-16 was the first American military plane to go into regular service with "gull-wings," or a virtual interruption of the upper wing across the fuselage.

Monoplanes come back

At this point we pick up another broken thread. Monoplanes had never been very popular in American pursuit aviation, and they disappeared even from the experimental area in 1923, with the last of the MB's. They began to come back in 1930. Boeing built experimental monoplanes both for the Army and the Navy, and within the past few weeks they have completed another. Designated the XP-936, it is of low-wing form, with dural wing covering and a supercharged Wasp. The performance has not been released for publication, but the general appearance suggests something over 220 m.p.h. at low altitudes. The Army is now bringing out too, a two-seater, low-wing monoplane with a Prestone-cooled Curtiss Conqueror and a retractable landing gear. It will reach service test the coming summer. Although they have not yet reached the point where their characteristics, or even their source can be publicly discussed, it is known that other monoplanes are under development.

These curious cycles of popularity and oblivion have always been characteristic of monoplanes in almost all countries. Principally as the result of unexpected aerodynamic and structural difficulties, especially in the days when little was known of the characteristics of thick wing sections and still less of the causes and nature of wing flutter, monoplanes as a type have been prone to suffer from sudden panics among their potential users. Our knowledge of aerodynamic and structural theory has now progressed far enough so that there should be no occasion for any categorical debarring of the type in future.

The swing back towards the monoplane is one of the notable features of pursuit development of the last year, and one of the things that seems likely to develop into a continuing trend. Another apparent trend leads the designer away from steel and into the light alloys. The Curtiss XF7C-1, built in 1927, was the first pursuit machine to forsake the classic welded steel-tube fuselage in favor of riveted duralumin tubes. The P-16 was the first to introduce metal wing spars, in pursuit aviation, although they had been used some years previously in other types. The present tendency, as in most other types under development for the Army, is towards the duralumin monocoque fuselage. The XP-936 exemplifies this.

A third trend of importance accentuates performance. For a period of several years the principal stress was thrown upon the military qualities and good maintenance characteristics. The amount of equipment carried was increased. The pilot's accommodations were made more comfortable in order that he might function more efficiently, and the performance remained almost unchanged. Now, despite the fact that there has been no official American participation in high-speed competitions for a number of years, the pendulum is swinging back towards a demand for greater emphasis on high speed, and so on aerodynamic fineness.

The fastest machine listed in the table on page 292 makes 189.5 m.p.h. There are, however, a number of experimental machines under development which are expected to do considerably better, although full details are not yet available. In recent testimony before Congressional committees on the Appropriation Bills for next year, General Foulois said that there would be pursuit planes coming out in the spring of 1932 which would do approximately 250 m.p.h. They were to be furnished with liquid-cooled power plants. Commander Mitscher of the Navy reported the existence of a two-seater fighter, under trial by the Navy, making 195 m.p.h.

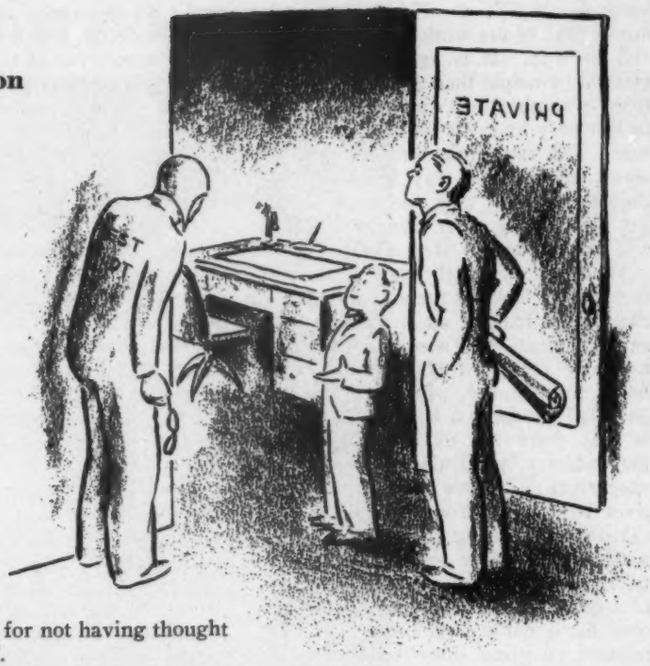
In the opening paragraphs of the article mention was made of the six pursuit types that were recognized by the Army in 1921. Almost all the purchases in the past ten years have really been made in a single category. At the moment it would appear that the only distinctions that can be drawn are between the single-seater and two-seater and, to a very limited extent, between th pursuit machine intended exclusively for high-altitude fighting and that which must be able to function efficiently at low altitudes and to show a very high maximum speed near the ground.

It appears likely, however, that there will be a certain increase in specialization in the near future, and in particular an increased differentiation between low-altitude and high-altitude pursuit. The extent to which that can be pressed will of course depend largely upon the willingness of the Bureau of the Budget and Congress to provide the necessary funds for the proposal.

A close observer of aviation asks a question

Where is the executive?

By
James B. Taylor, Jr.



THE aircraft industry seems to be an outstanding example of a young industry in which, while there is a great deal of enthusiasm, there has been a sad failure to get down to fundamental business principles,—for, after all, practically all business must be run on the same fundamental principles in order to make money. The executive, in any successful business, is defined as the man to make the final decision on matters of policy. His further function is to watch costs, and not only the total cost of the article produced but the cost of its individual component parts.

Now look at the typical aircraft company. In nearly every instance, the engineers seem to dominate the business. There are very few laymen who can tell you the name of the chief engineer of any of the automobile companies, but almost anyone interested in aviation can tell you the chief engineer of the aircraft company. I do not wish to belittle the part the engineer has to play. I am an engineer myself by training, and fully realize the importance of the profession to industry, but it must be realized that most engineers are heavily biassed by their own opinions, and also in many instances are in the position of having to justify their own work. In other words, if the engineer reports favorably on a new idea from the outside he is liable to criticism for not having thought of it first himself.

If a representative of a company manufacturing oleo struts, floats, or any other important parts, goes to a large manufacturer to try and sell his product, the first person he is sent to is likely to be the chief engineer or one of his assistants, who will be firmly convinced that his own department can turn out a better article than any outsider. In 99 cases out of 100 the company will not have the faintest idea just what their home-made strut or float costs them. This is where the executive should come in. He should be able to weigh the cost of his company's product impartially with that of the outside supplier, and decide which is really cheaper, taking quality fully into account. It is a matter of plain common sense that an outside manufacturer making struts, for example, for ten or twelve firms should be able to produce them cheaper than the firms themselves, whose individual production could hardly be one-tenth of his. The same thing applies to many other parts of aircraft, such as ribs, ring cowls, etc. I know of one company which charges $190 for a ring cowl for their ship, while an identical cowl can be bought from another company for $110 retail. Possibly the first company makes no money at $190, probably neither does the second one at $110, but it seems a matter of good business for the first company to make a deal with the second and buy the rings. The reason they do not is found again in the fact that the chief engineer states that the other cowl is inferior to his own, but he has never tested it to find out.

In another instance, it was pointed out to a well-known designer that a very big concern, formerly entirely devoted to automotive work, was equipped to make spot-welded ribs made of stainless steel. These ribs have been approved by the Department of Commerce and can be bought at a very reasonable price, weigh practically no more than a wooden rib, and are much stronger. The designer, however, stated that in his opinion wood was the only thing to make aircraft out of, and in any case he would not give a drawing of his rib to any outside company for fear they would copy it. This certainly seems to be a very short-sighted policy.

There is also a tremendous amount of duplication of effort in the aircraft industry. Four or five of the large companies have their own private wind tunnels and their engineers will tell you that these tunnels are invaluable largely because they are afraid that if they went to one of the commercial tunnels,

¶ The author of this article is a difficult gentleman to define. He is a sportsman pilot, a private owner, an airplane salesman, and an industrialist. He is educated as an engineer, and experienced in business administration. He has done a great deal of experimental and test flying. And it has all left him with strong convictions on some of the fundamentals of the aircraft industry and its conduct. No doubt his article will excite controversy and some dissent. It presents the very explicit views of a close observer and a candid friend of the aeronautical industry.

such as M.I.T. or N.Y.U., someone might hear of the work they were doing and copy it. It is again a matter of general principle that any firm that has to copy another firm's ideas is not going to last very long If they have no engineers who can work out their own designs, and in this way keep ahead of the other fellow, they will certainly not get far copying their competitor, as he will always be one step ahead of them.

When one goes through an aircraft factory and looks at the amount of work required in making an airplane, even in small production, it seems that the costs are way too high when compared to boats, for instance, which are also built on small production basis. One reason is that there are too many people in the industry, particularly high-salaried executives. I know of several executives who, aside from getting good fat salaries, are getting commissions on the gross sales. Now any man who will take a commission on the gross sales of a company that is losing money hand over fist is not a good executive. Commission on gross sales is decidedly not good business practice. It is good policy to provide some form of special compensation for employees of a company who have done good work, but it certainly should not take effect until the company is making money. After all, the first duty of any organization is to pay a return to the people who have invested their money in it.

Also most aircraft companies seem to have a tremendous force of draftsmen. No one seems to know just what they are doing, and it is doubtful if any of the executives of the company could tell you, but nevertheless they are there. I know of one company who have just received a nice order. They have made practically no changes in the machines since the first two or three were built, which were used as demonstrators, but since getting the order they have increased their drafting force three or four times. This again is a case of engineers running wild and doing what they always longed to do, working out a great many designs for the future which probably will never be built.

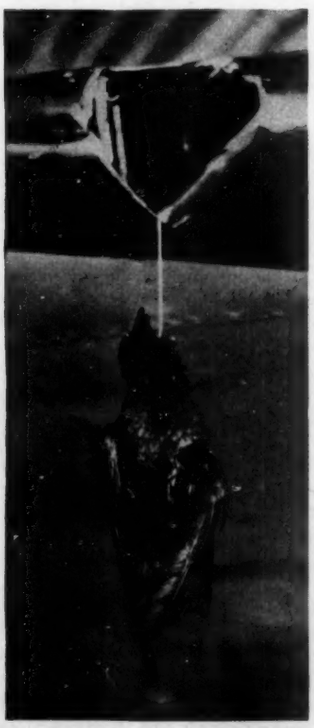
Another place for the executive to step in is in regard to correct and adequate testing of the airplanes his factory turns out. There have been many cases where test pilots have lost their positions because they criticised an airplane. Whenever that happens there is certainly something wrong,—not with the pilot, but with the company. If the test pilot is not capable he should be gotten rid of, but if he is the executive should certainly put some faith in him. In any case, it is up to a company to have a good test pilot upon whom they can rely. There are too many airplanes built today which are not quite right. They are good enough to pass the Department of Commerce test with a certain amount of wangling, but they really are not 100 per cent.

It is also surprising how much time and money is wasted by manufacturers who sumbit airplanes to the Department for test which will not pass. The Department's requirements are plainly written and there are pilots, although not very many of them, who are capable of telling quite definitely whether or not an airplane will pass these tests. If you ask the Department's engineering inspectors, however, you will find that it is only comparatively rarely that a machine goes through all their tests the first time, and usually they are blamed for being too strict.

There are airplanes built today that are right on the ragged edge of passing the Department, and some which almost surely would not pass if they were submitted to test again. In nearly every instance the designer knows this in his own heart, but he will not admit it, and he points out the ship's desirable features, minimizing undesirable ones.

If a test pilot or any outside pilot goes to the chief executive of a company and criticizes the ship in any way he is ordinarily sent promptly to the designer, instead of the executive investigating the matter thoroughly himself and then, if his informant is right, making the designer correct it. It would well repay any company to employ several well-known pilots to fly a new ship and give independent written reports on their findings. These reports would naturally be confidential, and if a majority of the pilots agree on a certain fault it would seem fairly safe to assume that it really exists.

In conclusion, it seems that it is about time for us to get some real executive minds in the aircraft business to cut down all the wastage and duplication of effort, get a little more friendship between different companies instead of so much jealousy, get some real cost figures, and build airplanes at a price which would allow some money to be made in selling them and at the same time at which the public could afford to buy them. The automobile industry suffered in its early days from the same trouble that we are experiencing, but I do not think it suffered so long.



Aviation

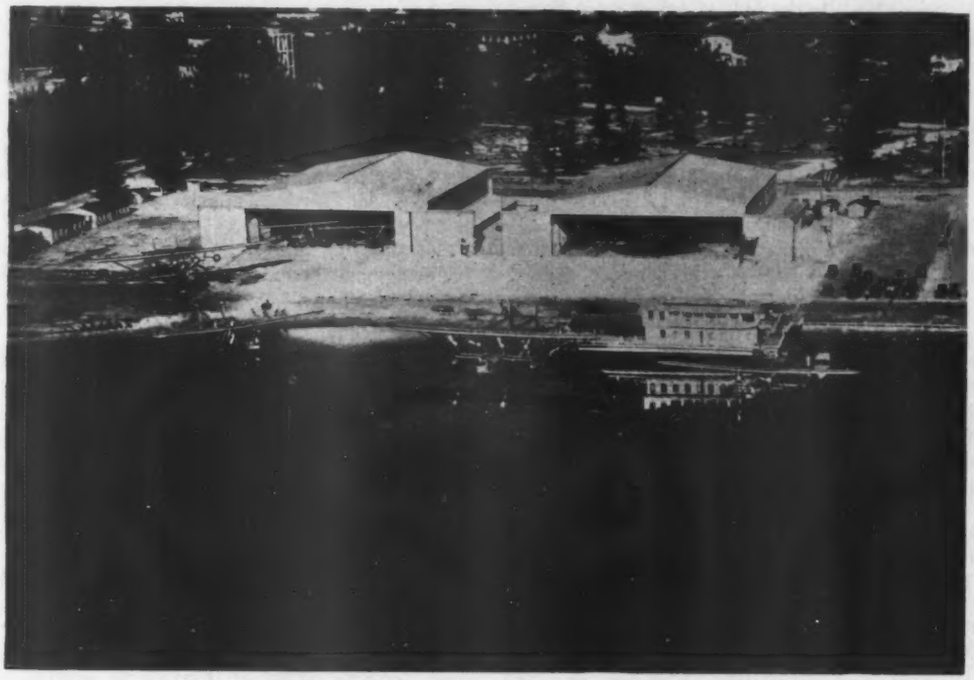
The crow's remains after they had been extricated from the wing.

Crow into airplane

SEVERAL letters written recently by officers of the Royal Air Force to British journals have revived old discussions on the effect of aircraft striking birds in flight. As our contribution to the literature in this field, we offer an incident which came under our personal observation recently at one of the western stations of a well-known airline.

A mail pilot on landing reported that he had flown through a flock of birds. A break was found in the leading edge of the left wing about 15 ft. outboard from the fuselage. The dural leading edge had been punched inward just beyond a rib, and the nose-piece of the rib had been collapsed inward. Further investigation with a flashlight disclosed the body of a bird wedged inside. The remains, when extricated through the break, proved to be those of a common crow. The head, back, and wings were practically intact, although the major portion of the crow's fuselage and undercarriage were missing. Fortunately the flying qualities of the airplane after the accident were not noticeably impaired, and it was a relatively simple job to repair the rib and leading edge, but considering the degree of structural damage caused by a crow (weighing probably 1½ lb. or 2 lb. at the most) it is not difficult to visualize the effect on a high-speed plane striking a bird of somewhat greater weight. At least one British pursuit plane stationed in India has been completely wrecked by striking a large bird flushed from an airdrome during take-off. One recent pilot's manual goes so far as to recommend that a plane be taxied the full length of a runway before take-off to frighten away birds whose presence is suspected.

THE SECOND ARTICLE OF A SERIES ON MAINTENANCE



The Pan American Dinner Key flying boat base—The structure off shore is the passenger terminal — The planes are boarded from a float on its outboard end.

Checking Caribbean cruisers

A study of Pan American's base at Miami

IF, ON a map of the Americas, four lines are drawn,—Brownsville, Tex., to Miami, Fla.; Miami to Para, Brazil; Para to Panama; and Panama to Brownsville,—the diamond-shaped area thus inclosed represents roughly the territory served by the Western and the Caribbean divisions of the Pan American Airways System. The Western division operates over the Central American leg of the diamond, flying overland from Brownsville to the Canal Zone with branch lines into Tuxpan from Tampico, and from Vera Cruz to Merida, in Yucatan. The Caribbean division is almost entirely an over-water operation, whose routes extend fan-like from Miami, into Yucatan and San Salvador; to Cristobal in the Canal Zone; and to Para by way of Trinidad. A connecting line from Trinidad to Cristobal across the northern coast to South America, serves Caracas, Maracaibo and Barranquilla, Connections are made at the Canal Zone with Pan American-Grace Airways and at Para with the west coast lines.

Operating wholly outside the boundaries of the United States over open seas and along many miles of uncharted coast line, the Pan American System faces operating and maintenance problems unknown to the average overland airline. It has been necessary, for example, to develop and maintain a complete communication and weather reporting network over some 7,000 miles of airway. A number of remote servicing stations must be kept at a high state of efficiency to insure proper care of flying equipment all along the line, and complete facilities for the overhaul of airplanes, engines, and all their accessories must be constantly maintained at Miami. The Consolidated Commodores, Sikorsky Clippers and other amphibions and the Caribbean fleet put in a daily average of 4,750 miles under conditions where forced landings cannot be tolerated. It speaks well for the character of work done by the maintenance departments that an average of better than 99 per cent of regularity has been maintained over the entire system during the past year. The absolute safety of passengers and crews is paramount.

In each division the maintenance base is located at the northern end of the routes, at the point where the lines make contact with the United States. Miami takes care of all flying equipment on the Caribbean division and Brownsville serves the Western division. Each division has a complete organization of its own, with a division manager under whom come the four principal operating functions—traffic, operations, engineering and communication. All maintenance operations except those pertaining to the upkeep of radio equipment fall under the immediate supervision of the divisional engineer. For administrative purposes, the latter reports directly to the division manager, but for matters pertaining to the technical aspects of the flying equipment, he is constantly in touch with the office of the chief engineer in New York. A parallel situation exists in the communications department, which falls under the general supervision of a chief communications engineer, also located in New York. The divisional engineer not only looks after the work at the maintenance bases, but has supervision of all field servicing and inspection over his entire division. Where two divisions make contact, as

at Cristobal, Para and Merida, responsibility for servicing of all airplanes touching those points is definitely allocated to one division or the other.

Maintenance routine

At every fueling stop on every flight mechanics inspect all engines and propellers, and make any minor adjustments which are needed. At every overnight stop the airplane and its engines are given a so-called "short service" which, for the engines consists briefly in the following steps: (1) fill gasoline tanks; (2) check oil level; (3) remove and inspect front spark plugs to facilitate checking valves and compression; (4) remove rocker box covers and inspect and lubricate valve rocker mechanism; (5) remove and clean gasoline strainers; (6) check rear spark plugs for tightness; (7) check engine mount and engine control system for proper functioning and tightness; (8) clean.

Schedules are so laid out that all airplanes on the Carribean division pass through the maintenance base at between 20 and 30 hours of flying time, and are then held over at Miami for the so-called "long service." At these periods, in addition to the items scheduled under the standard short service, the following operations are carried out: (1) change lubricating oil; (2) change spark plugs; (3) check valve clearances; (4) check magneto breaker assembly for wear and clearance; (5) remove carburetor jet plugs and flush carburetor; (6) remove and clean all gasoline and oil strainers.

Airplanes undergo a standard "short service" and "long service" on the same basis as the engines. The short service includes a complete visual inspection of the exterior and all its fittings, including a check on engine mount, fuselage structure, control system, and all safety wires and pins. The landing gear is checked, and the entire hull is gone over to catch any obvious damage from handling or beaching. In addition, at the long service period, the hulls are thoroughly flushed with fresh water and inspected in detail for condition of paint or protective grease coatings.

Landing gears and brakes are thoroughly inspected and greased, all control hinges and pulleys are lubricated, the cables are cleaned, all Zerk fittings are lubricated, and the airplane is thoroughly cleaned, both outside and inside. After about 1,000 flying hours, which may vary somewhat due to the conditions of service under which the machines are operating, all airplanes are laid up for a complete overhaul and inspection. For flying boats and amphibions, this includes a complete removal of paint and protective coatings from the hull and a very thorough inspection for corrosion. Fabric is removed from wing and tail surfaces, and the interior structure and fittings thoroughly inspected and repaired where necessary. If corrosion is suspected at any point in the hull of either main floats or wing floats, the plating is stripped off and replaced by new material. Any doubtful-looking rivets are cut out and replaced.

As it would be expected, one of the major maintenance problems connected with the operation of all-metal flying boats in the tropics is corrosion control. Pan American Airways is constantly conducting accelerated corrosion tests to determine the relative efficiency of paints and other coatings.

One of the most effective methods evolved so far is in the liberal application of a mixture of resin and beeswax to all exposed parts and fittings. This material is smeared on in a thick butter-like coating, and every time the plane is beached the coatings are thoroughly inspected and renewed if necessary. Interior fittings coated in this manner will be protected without a new application for as long as four to six months, but for exterior fittings, particularly those exposed to water spray, renewal may be required every trip. The interior surfaces of struts or tubes are kept covered with a light coating of ordinary engine oil applied by means of a spray gun. Hull bottoms exposed to the direct scrubbing action of salt water will not retain the beeswax-rosin mixture for any length of time, so a compound known as No-oxide, (Dearborn Chemical Company) is used. It was formerly the practice to coat the entire bottom, but recent tests have indicated that application over the riveted joints only gives complete corrosion protection.

Parts and accessories

Propellers and hubs are given thorough visual inspection at the "short servicing" period. They are removed and sent to the propeller shop at every engine overhaul period. They are there disassembled and the blades etched at every overhaul. The hubs are thoroughly cleaned, examined with a microscope, and repainted with a mixture of aluminum bronze powder and spar varnish. On the rare occasion where bent blades occur, they are checked with a set of templates to determine whether they may be straightened in the local shop or whether they must be sent back to the manufacturer for straightening and re-heat treatment.

The principal problem with propeller blades is pitting and corrosion from salt water spray. Minor roughening of leading edges is cleaned up with file and crocus cloth. Badly pitted blades are cut back to one of a definite series of three standard profiles to work to. Blades are given a high polish before assembly, as it has been found that smooth surfaces tend to resist corrosion and pitting.

Unless pilot's report indicates previous faulty operation of certain instruments (in which cases they are immediately rectified) all engine and flying instruments are removed from the airplane and sent to the instrument shop at the same time that engines are removed for overhaul. As a matter of routine, the functioning of each instrument is checked by an instrument man every time airplanes come into Miami for the "long servicing."

All storage batteries are changed at the end of every day's run. Every terminal station is equipped with battery-charging apparatus, so that a reserve supply of fully charged batteries is always available along the line ready to go into any airplane at the beginning of a day's run. In the course of time all batteries pass through the Miami station where complete records of their life and general condition are kept. Sixty-ampere-hour Exide batteries are standard equipment.

Magnetos are removed from engines at the regular engine overhaul period, and are completely torn down and inspected for electrical and mechanical condition. Unless it is necessary to change a magneto at some outlying station, all magnetos remain with the engine on which they were originally furnished. Generators and starter are checked at every engine overhaul.

Spark plugs are changed at Miami at every "long servicing." They are sent to the engine shop where they are completely disassembled, cleaned, electrodes repaired, reassembled, checked for clearances, tested under pressure, and returned to the servicing department shop at Dinner Key. B.G.-4B1 and 1XA plugs are standard equipment.

Servicing and overhaul bases

The seaplane base at Dinner Key (Miami) is a busy place in the late afternoon. One after another, at fifteen or twenty-minute intervals, the Commodores climb up over the horizon to settle in the blue water of Biscayne Bay. Last of all, a Clipper drops in to complete its daily round trip to Havana. With promptness and dispatch, the big boats are warped to the unloading dock and a few minutes later are turned over to the beaching crews who float out and attach the beaching gear and tow them up the ramp to the servicing hangars with a small gasoline tractor. The equipment is then in the hands of the maintenance department, and the ultimate responsibility of returning it in shape to fly its next schedule rests with the division engineer.

The two servicing hangars at Dinner Key are located some 50 yd. back from the beach on the site of the old Naval Air Station hangars. They stand on filled ground, with floor levels some 6 or 7 ft. above tide-water to avoid flooding under hurricane conditions. The buildings are standard Pan American 10x140 ft. hangars, equipped with slid-

ing doors at both ends. A lean-to along one side of each provides space for locker rooms, offices, and small shops. Following standard Pan American practice the corrugated cover is made of Robertson protected metal.

As the work at Dinner Key is confined to servicing operations only, there are no extensive shops available there for major overhaul work on either airplanes or engines. The station is well equipped, however, for ordinary inspection and servicing checks and a certain number of wood and metal-working tools are available for emergency use. A Skinner oil reclamation unit is a part of the regular equipment. Overhaul operations are effected at the inland 36th St. base. Flying boats and their engines are dismantled at Dinner Key and sent to 36th St. base by truck for overhaul. Amphibions are flown in under their own power.

The shops and offices at 36th St. are located in a row of buildings along the north side of the field. The overhaul shops are located in hangar No. 1 at the extreme western end of the line of buildings. Engine test stands and oil storage facilities are set up just outside of this hangar. The sheet metal shops, engine teardown, wood shops and airplane assembly floor are in the main part of the hangar. A lean-to on the west side houses the stockroom and one on the east contains the engine overhaul shop. Going eastward down the line, the next is the administration building. Further east, hangar No. 2 is used principally for storage although a lean-to houses the radio shop and radio stockroom. Between hangars No. 2 and No. 3 stands building No. 2A, a small brick enclosure housing a one-cylinder engine for making knock tests on gasoline. Hangar No. 3, the last in the line, is also a general storage hangar, with chemical and material testing laboratory, propeller overhaul shop, and wing covering shop in the lean-to on its west side.

Stores and supplies

Stock for all departments, with the exception of the radio division, is carried in the main storeroom housed in the lean-to on the west side of hangar No. 1. The south end is devoted largely to engine parts, which are kept well sorted out in large wooden bins. Hardware and small parts, including standard sizes of nuts, bolts, pins, etc., are carried in the central section of the room, and the northern end is devoted to the more or less bulky raw materials, principally for the use of the airplane overhaul department. Due to the somewhat remote location from supply centers, a relatively large stock of such materials as steel and aluminum tubing, steel, brass and aluminum sheet, rubber and copper hose, gasket materials, etc., must be carried. The Miami stockroom carries supplies for the entire Caribbean division, and supplies the needs of the outlying stations as required for such materials as may not be obtainable locally.

Airplane and engine overhaul

All airplane overhaul work is carried out at 36th St. The hulls, wings and other parts are placed in the central part of hangar No. 1 and are completely stripped. All parts, fittings, etc. are inspected thoroughly, tagged with the number of the airplane and routed into the proper shop. The sheet metal and welding shop occupies a portion of the main hangar floor space along the east side. In the croner of the hangar floor adjacent to the field on the west side an enclosure houses the woodworking shop to take care of the plywood paneling which lines the cabins.

The sheet metal shop is thoroughly equipped for handling a wide range of work both in sheet steel and in duralumin. Except for the making up of occasional shop equipment, there is very little welded-steel-tube work done here, as compared with other shops handling land-type airplanes. The sheet metal shop, however, turns out exhaust collector rings and magneto shielding boxes, as well as formed and bent duralumin sheets in a wide variety of shapes. It also handles all gasoline tank work, as well as sheet metal cowling of all types.

Wing and tail surface frameworks are sent over to building No. 3 for application of fabric and doping. For working on wings after dismantling from the airplane, a very ingenious wing jig has been developed, in which the wing is so mounted that two men can roll it over or shift it about.

Not only is every part of the airplane subject to continual inspection during assembly, but the entire machine must be passed by one of the divisional inspectors before it is permitted to be test flown. It is then given a series of test flights under full load, re-inspected and released for service on the line.

Engines are removed from airplanes and sent to the shop for complete overhaul at regular intervals specified for each type of equipment. The time intervals are based on true flying hours, and are computed from the airplane log book. Warming-up time, taxiing time, etc., which make up an additional 10 or 12 per cent are not included. Under present operating conditions the Miami engine shop is handling sixteen or seventeen engines per month.

As contrasted with the crew system where one man and a helper carry the overhaul of an engine through from beginning to end (as is found in some shops) the engine overhaul shop at Miami is organized on a strictly production line basis. The engine from teardown to reassembly passes from one end of the shop to the other, and each part or sub-assembly is taken care of by a specialist.

As the first step the engine is torn down completely and is given a very thorough cleaning. All parts are spray-cleaned with a light grade of petroleum spirits or dipped in Oakite and all carbon removed by scraping. The completely disassembled parts of each engine are placed on special part racks, so designed that there is a special place for every part. All parts after disassembly are tagged with the engine serial number. The tags remain with every part until the engine is reassembled. Cylinders are sandblasted, to remove all old enamel. The cylinders are then enameled, using a spray system, and the enamel hardened by oven drying. Two coats of enamel are baked on. This is the only process found which will successfully resist tropical conditions.

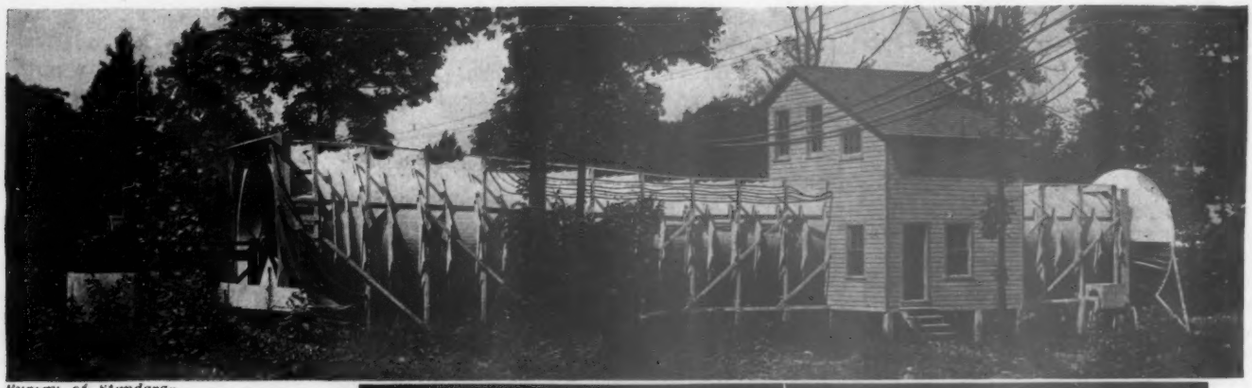
When necessary, the cylinders are reground. Reground cylinders are identified by a yellow stripe which is painted on the barrel, just above the flange. The amount of over-size is then stamped on the flange immediately below the yellow mark. In this way pistons and piston rings may be properly fitted, no matter where and when such work is necessary.

After cylinder painting, the valves, valve seats and valve springs are inspected, and any necessary work is completed. Valves are faced on a Kwik-way grinding machine and the seats are faced with a special facing tool. Valves are lapped after facing.

After a thorough cleaning, pistons are inspected for wear and new rings are fitted. Pins are checked very closely for wear, and any falling outside the limits set by the manufacturer are replaced. Crankshafts and connecting rod assemblies pass down a series of benches through the center of the shop, where they are closely examined for cracks or signs of wear. After inspection, bushing and reaming and reassembly on the crankshaft, the entire unit is given a light coating of oil, covered up with a dust-proof bag, and stored out of the way until the rest of the engine assembly is ready by suspending from hooks hung from the roof.

At the Miami shops, the overhaul of magnetos, starters, carburetors, spark plugs and ignition wiring is carried out in the engine overhaul shop proper, and the supervision of the crews doing these specialized jobs comes immediately under the control of the engine shop foreman. The same is also true of the machine shop, which is an integral part of the engine overhaul.

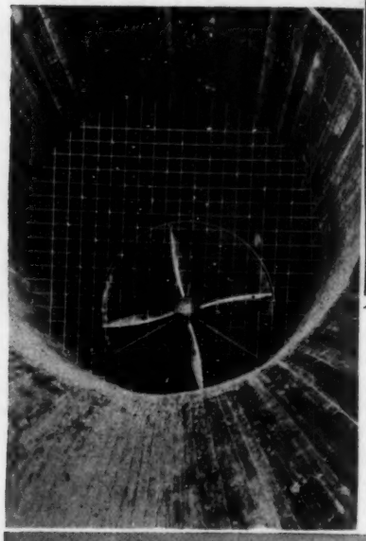
After complete assembly and final inspection, the overhauled engines are removed to the test stand, where they are run in for eight hours under varying throttle conditions. A complete log is kept of the behavior of the engine on the test stand and any difficulties encountered during this period are corrected before the engine is finally approved for service.



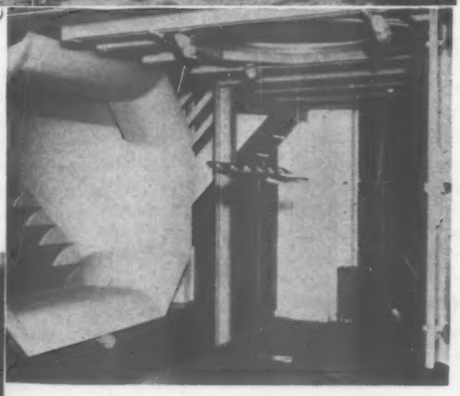
Bureau of Standards

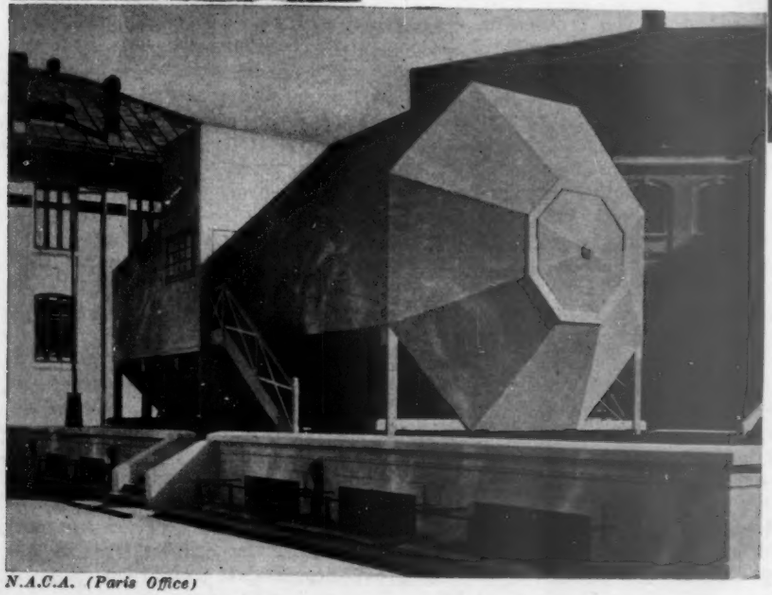
Above: The outdoor tunnel, built in the early days of aerodynamic research by the Bureau of Standards, was insensitive to external air current. Right: The huge guide vanes in the return passage of the full-scale wind tunnel at Langley Field. Far right: Autorotation tests are made in the 5-ft. vertical atmospheric tunnel at the N.A.C.A. laboratories.

Aviation *N.A.C.A. (above, left)*



Left: The propeller section of the wind tunnel at the National Research Laboratory at Ottawa. Below: Entrance cone end of the tunnel at the Bucharest Polytechnical Institute. Right: Entrance cone and test chamber of wind tunnel at the Focke-Wulf plant at Bremen





N.A.C.A. (Paris Office)

Wind tunnels

Important research apparatus on two continents

An account of the Seventh Annual Engineering Conference of the N.A.C.A.

Pilgrimage to Langley

A YEAR'S RESEARCH PROGRESS

FOR the seventh time, the engineering talent of the aeronautic industry has made its annual pilgrimage to the secluded shores of Langley Field, to learn what progress has been made in the research work of the National Advisory Committee for Aeronautics.

Attendance at the conference was apparently unaffected by business conditions, and the quota was filled by representatives who came not only on the night boat from Washington, but by airplane and in at least one case by private yacht. The number of travelers by air was distinctly greater than ever before. It is almost unnecessary to say that the program progressed in its usual efficient manner, with strict adherence to schedule, under the direction of Dr. Joseph S. Ames, chairman of the Advisory Committee, and Henry J. E. Reid, engineer-in-charge of the laboratory.

Already the effects of the full-scale wind tunnel are being felt in the fundamental research programs of the Committee, and a check of the tunnel results has shown agreement with actual flight results within 2 per cent in the case of the Fairchild-22 monoplane. A speed of 58½ m.p.h. has been obtained in the new towing basin, and the program for this apparatus is under way.

As the several fundamental research problems under investigation by the Committee unfold, the high degree of coordination between the various sections of the laboratory becomes increasingly apparent. The breadth of viewpoint attainable on a single problem through the process of breaking it down for separate study by each of several sections produces results invaluable to engineering progress. With the curtailment of individual research by private units in the industry, the work is receiving even greater appreciation.

Early morning

Following the usual introductory remarks, the morning discussion was turned over to Elton W. Miller, chief of the aerodynamics division. He outlined the work of the variable density tunnel section, under the direction of E. N. Jacobs and John Stack. Sixty airfoils have been investigated in a systematic study of the aerodynamic effect of changes in thickness and camber, and the work has resulted in the development of sections better for particular application than any that were previously tested. In comparing characteristics obtained by theoretical computations with the results of actual measurements, it was found that the magnitude of the apparent discrepancies depended primarily on thickness of the airfoil. Moment coefficients at zero lift, for example, were found to average about 25 per cent below the theoretical value, with the correction larger for the thicker sections.

One of the most important developments growing out of this research is a particular section designated N.A.C.A.-2412. (The number indicates a maximum thickness of 12 per cent of the chord and a mean camber of 24 per cent.) This section was tested with two modifications having reflexed trailing edges, giving a practically stable center of pressure and very little change in drag coefficient up to the stalling angle. An amount of reflexing sufficient to give a stable center of pressure in this airfoil cuts the maximum lift coefficient only 6 per cent.

The limit of high speed

Through the use of a high-speed wind tunnel, it has been possible to test airfoils up to about 90 per cent of the speed of sound, or nearly 700 m.p.h. A chart was exhibited, showing the drag characteristics for the N.A.C.A.-0012, a symmetrical airfoil of 12 per cent thickness plotted against air speed. The minimum drag coefficient was nearly constant at all speeds up to 500 m.p.h. At that point compressibility took hold, and between 500 and 600 m.p.h. there was a rapid increase of drag coefficient to five times the normal value.

The sharp rise of drag at very high speeds corresponds to a definite loss in propeller efficiency when tip speed passes beyond 1,000 ft. per sec.

Where should engines be placed?

One of the most important research programs has been that devoted to an investigation of wing-nacelle-propeller interference. The committee is now turning its attention from tractor to tandem propeller installations, and some of the preliminary results were shown. Conclusions thus far indicate that the mean efficiency of tandem propellers is 5 per cent less than that of a single propeller, and that properly-cowled single engines are better than tandem engines. The net efficiency, taking account of drag, is 40 per cent better for installations below the wing than for those above. A single cowled engine above the wing shows a net efficiency of 0.63, and a cowled nacelle sunk in the wing gives 0.75, the best value among all the positions tested.

Mr. Miller next discussed the program of the full-scale tunnel, which has been thoroughly tested for accuracy against flight tests. One of the first assignments was the work of solving the cooling and cowling problems in a nacelle of P3M-1 flying boat for the Navy. By closing the open tail of the nacelle and substituting louvres an increase in net thrust of 20 per cent was obtained. Installation of ring cowling produced even better results.

Research for safety

Following Mr. Miller, the meeting was turned over to Fred E. Weick, who is directing the aerodynamic safety investigation in the atmospheric tunnels. The activities of this section have been devoted for the most part to a series of investigations on various lateral control devices at the high angles of attack, where standard ailerons are unsatisfactory. Among the important findings so far is the fact that the apparent optimum length of slots for stability is about two-thirds of the semi-span. With slots of proper length, the angle of attack above which autorotation of the wing would start was increased from about 17 deg. to over 30 deg.

Another program closely associated with the safety study, is one aimed to increase the speed range. Several devices for this purpose are in the process of being tested, including various combinations of slots and flaps, plain or split, and variations of area. Tests have also been made on a combination of a Clark Y wing with a narrow auxiliary airfoil having 15 per cent of the chord of the main wing, and successively tried in about 140 different positions with respect to the wing. The maximum gliding angle of a Fairchild-

22, equipped with the fixed auxiliary airfoil in the optimum position was increased from 8.1 deg. to 19 deg. The minimum angle remained unchanged at 6.7 deg., giving a range of angles of descent of 12.3 deg. as compared with 1.4 deg. for the original airplane. The auxiliary airfoil decreased the maximum speed 2.5 m.p.h. and the minimum speed 10 m.p.m., and the rate of climb was unaffected.

Testing in flight

Touching upon some of the more important work of the flight research section, J. W. Crowley, Jr., spoke first on the investigation of rotating wing systems, for which the Committee has purchased an autogiro. Preliminary flight measurements of the aerodynamic characteristics of the autogiro have been completed, and show a maximum value for the lift coefficient at 33 deg. The minimum vertical speed in glide is 15 ft. per sec., at 36 m.p.h., and the speed of vertical descent 35 ft. per sec. A pressure distribution investigation is now under way to determine the distribution of loads between the rotor and the fixed wing, and to ascertain the loads applied in maneuvers.

The ever-important spinning investigations have received a great deal of attention during the past year in the flight research section. An important phase has been the determination of the nature of airflow about the tail surfaces in the spin by photographic recording of smoke flow over the surfaces. The photographs prove that blanketing of the rudder is an important factor in a spin, and that additional area provided below the horizontal surfaces is helpful in many cases in insuring recovery.

After brief mention of the progress of the flight investigation of the load distribution over wing-tips to determine the relationship between tip shape and load distribution, Mr. Crowley pointed out that results so far obtained have indicated a distribution of load quite independent of tip form. The flight section has been engaged in a number of general load investigations to formulate rational methods for predicting the critical loads that may be encountered in flight, and a quantity of statistical information has been obtained. It appears that the load factors imposed in pulling a plane out of a dive are substantially independent of the stick force that has to be used. It appears that the pilot more or less unconsciously adjusts the rapidity of recovery to the magnitude of the load factor, as felt through the pressure on the seat. To aid in the accumulation of load factor information, the laboratory has developed a new instrument, known as the V-G recorder, which makes a permanent record of acceleration and air-speed simultaneously and which can be left in place on a plane for a period of months.

For the first time at any conference, the meeting was addressed by Dr. Theodore Theodorsen, chief of the physical research division. Dr. Theodorsen spoke briefly on the problems associated with tunnel wall correction, and heat transmission from airfoils.

The work of the power plant division, as outlined by Carlton Kemper, was centered around various methods of increasing output, efficiency and safety of engines. In connection with efficiency, the power plant section has been working to obtain improved scavenging for fuel injection engines by means of exhaust and intake valve overlap. An overlap of 112 deg. was found to be the optimum. With this arrangement, a compression ratio of 6.5, and a super-charging pressure of 6 in. of mercury, a brake mean effective pressure of 215 lb. and a fuel consumption of 0.54 lb. per b.hp.-hour were obtained.

Preliminary experiments with the use of safety (hydrogenated) fuel have shown abnormally high consumption, but it has been possible to reduce this by the use of higher compression ratios and high temperature cooling. The new fuel has an octane number of 93, and a flash-point of 127 deg. In one instance, using safety fuel, a compression ratio of 7.5, and Prestone cooling, the consumption was the same as that with normal gasoline at a compression ratio of 5.5. The b.m.e.p. showed a 10 per cent increase with the safety fuel. A compression-ignition engine with overlap valve timing showed a b.m.e.p. of 110 lb. and a fuel consumption of 0.41 lb. per hp.-hour.

The comparative performance of three-engined airplanes with equal-powered diesel and carburetor engines was computed, and results indicated that, for equal payloads, maximum speeds, and cruising speeds, an airplane equipped with diesel engines would show a 40 per cent increase in cruising range and a decrease in fuel cost per mile (at present unit costs) of 64 per cent. Because of the constant value of the fuel consumption curve for a wide range of throttle settings, the diesel-engined plane would cruise with clear exhaust at a speed of 13 per cent in excess of that obtained with the carburetor engine, and still show an 8 per cent increase in cruising range and a 54 per cent decrease in fuel cost per mile.

Photomicrographs of various stages in the atomization of fuel jets indicate the formation of fine ligaments, which collapse under the influence of surface tension to form drops in the spray. An investigation has shown that the rate of vaporization of diesel oil under conditions comparable to those occurring in a high-speed diesel engine is sufficiently rapid to permit the combustion of a considerable part of the fuel from the vapor phase.

The towing basin

The new towing basin makes it possible to deal with fundamentals in hydrodynamics. Outlining the program for the installation, which includes a check of Froude's law of division of resistance and an investigation of the frictional resistance of hull and float bottoms at high speed, Starr Truscott, chief of the hydrodynamics division told of the work already done. While a portion of the period elapsed since the towing tank was placed in operation has been devoted to checking the performance of the apparatus, the program is now well under way, and includes a study of the resistance of seaplane floats of the single and twin-float types, flying boat hulls; planing surfaces, flat and hollow, and the frictional resistances of rivets, butt-joints, and other protuberances.

One of the first investigations undertaken was to determine the effect of small changes in form on the performance of a flying boat hull. This was accomplished by testing first a normal model and then applying systematic modifications. Results of these tests have already yielded interesting facts on the subject of flying boat design. It has been found that a "hook" at the step decreases the hump speed and increases the hump resistance slightly, and that well-placed spray strips along the chines cut the maximum resistance 10 per cent. The optimum width of a spray strip has been determined as 1 per cent of the beam. "Longitudinal steps," breaking the cross-section of the bottom up into a succession of concave arcs, have shown very little effect.

Late morning

While there were no such spectacular additions to equipment as the full scale wind tunnel and towing basin dedicated at last year's session, there was, as usual, far too much to be seen in the limited time provided, and it was with a great deal of reluctance that many of the visitors moved from one exhibit to another on schedule during the inspection period. The very complete study of variable lift devices, both fixed and movable, was underway in the 7x10 ft. atmospheric wind tunnel, and the most promising of these, as explained in the morning session, appears to be the small auxiliary fixed wing placed in front of and above the main wing. The Fowler variable-area wing has shown the greatest increase in maximum lift as applied to the Clark Y airfoil, the increment being approximately 250 per cent. The spinning balance which was introduced last year is now in use.

The most spectacular exhibit in the

variable-density-tunnel building was the new smoke-flow wind tunnel, recently constructed to provide a means for the visual study of airflow over various wing sections and the study of interference effects and to tie in with the smoke-flow work in the flight test section. It gives unequalled facilities for the direct study of the motions of the air. Titanium tetrachloride smoke passing through a specially-developed filter to provide a flow free from turbulence is used, and when there is no model in the tunnel the smoke streams through in smooth parallel filaments. The flow is susceptible, however, to outside disturbances such as vibration of the building. The demonstrator had only to stamp once on the concrete floor to set the smoke lines to chattering like an electro-cardiograph record from a heart with a leaky valve. Among the features of the demonstration were experiments to show the "circulation" around a rotating cylinder and the burbling of the normal Clark Y airfoil, compared with that of a similar airfoil fitted with a small auxiliary fixed wing such as the one under test in the atmospheric tunnel and in the flight-test section.

The demonstration of the propeller research tunnel, under the direction of Donald Wood, had been set up to show the pressure distribution over a metal aircraft propeller at various speeds of revolution. A standard propeller with a V-12 engine mounted on an Army pursuit plane was used and the result indicated by manometers on a chart. The tip speed of the propeller was increased gradually to and above the speed of sound, to show the limiting speed at which the blade is effective in producing thrust and beyond which the thrust near the tip becomes negative, actually retarding the progress of the airplane. A 20-ft. model of the U.S.S. Akron, used in examining the flow characteristics and pressure distribution over an airship hull, was on display. A number of small pitot tubes were used to survey the air velocity at various stages over the length of the ship.

With the exception of the provision of simplified explanatory charts no special preparations were made for visitors in the full-scale tunnel, and the demonstration, directed by Smith J. DeFrance, consisted simply of a typical test run with the Douglas YO-31A observation plane, recently purchased by the Army.

Flight test section

The exhibits in the flight test section were centered mainly around the pressure distribution program, smoke tests of spinning, full-scale checks on the work of the atmospheric tunnel in lift-increasing devices, and the development of new instruments for flight testing.

In the spinning work it has been found that a sharp leading edge on an airfoil greatly improved spinning characteristics, but reduced maximum speed (on a Fairchild-22) 4 m.p.h. and increased the landing speed about half that much.

Power plant section

The first demonstration in the power plant exhibit showed the improvement in engine operation, as a result of valve overlap, producing a more effective scavenging of the combustion chamber. The equipment for taking samples of the gases in an engine cylinder at different points of stroke and analyzing them, showing the steps in the progress of combustion, was on display.

The results of a study of fuel spray by the use of photomicrographs, showing how the fuel particles are torn apart into ligaments and then broken up into small drops mixing with the air in the cylinders in the process of injection, were shown.

Continuation of the work concerning heat flow characteristics from finned surfaces has shown that the amount of heat transferred from the fin surfaces increases almost 100 per cent if the air impinges upon the surfaces at an angle of 45 deg. instead of passing parallel to the fin.

Afternoon

Because of the limited time allotted to the afternoon session there was little opportunity for voluntary contribution, and all of the visiting speakers were called upon by Dr. Ames, who presided. The first to speak was Harold F. Pitcairn, who voiced his appreciation of the Committee's interest in the autogiro and pointed out that the autogiro problem was unique and should be handled on a full-scale basis. Mr. Reid replied that a program for test in the full-scale tunnel was underway. Edward P. Warner, editor of AVIATION, suggested that, although almost all the problems of design had been touched, there was a forgotten man in the person of the transport operator, whose interests had not been directly enough considered and whose representatives were not on hand in such numbers as they should have been. He advocated the formation of a special sub-committee to consider what researches would be most helpful in placing transport on an economic basis and in promoting passenger comfort and economy.

Following sundry remarks very complimentary to the committee and expressions of the industry's great obligation to the research work at Langley Field, Major Fleet of Consolidated Aircraft passed to the vital matter of budgets. He discussed the European situation with particular reference to the heavy armament of France, and reminded the gathering that in that country private owners were subsidized 50 per cent in the purchase of airplanes. If war should come, he feared that aviation in America would not be ready. Something should be done to impress budgetary officials with the gravity of the situation. Major Fleet admitted that one or two countries have engines of greater horsepower than ours, but he was confident that we led all our rivals in airplanes.

Greater performance without greater horsepower was the battle-cry of George J. Mead, vice-president of Pratt & Whitney Aircraft. All of the work of the Committee could be summed up in attempts to gain minimum drag and maximum thrust horsepower. Partly in reply to Major Fleet's remark regarding European engine supremacy, Mr. Mead contended that we could not afford to throw away power, but should concentrate our efforts on obtaining higher performance with present powers or less. In this connection he cited the development of the retractable landing gear. He emphasized the importance of increased passenger comfort, rather than increased performance alone, in transport operation. What was being done by the committee on the problem of transport regularity, with particular reference to the need for some means of getting down on the ground at the end of a blind flight?

Next was Ronald Chilton, who remarked that the fin test results of the Committee checked with the empirical results of the Wright Company and wanted more work along the same lines. He voiced confidence in the future of the two-stroke-cycle engine and asked for information on the basic valve or piston arrangement most economical for scavenging. To this Carlton Kemper replied that a liquid-cooled two-stroke cycle engines soon would be ready for scavenging tests.

Charles Ward Hall requested more information on the resistance of overloaded hulls and on the relation between float displacement and wing area and loading, and suggested the extension of the auxiliary airfoil investigation to wings tapered in thickness as well as in plan form. He further suggested that the nacelle-position study be extended to cover biplane cellules, and requested an aerodynamic investigation of in-line and V-type air-cooled engines, with particular attention to their cowling possibilities.

Sherman Fairchild requested an investigation of the cowling possibilities of in-line engines, with particular reference to inlet and exit openings. Before the N.A.C.A. began its work on radial engines, they were far inferior to in-line type in point of resistance qualities. They had now caught up, and it should be the turn of the in-line power-plants to benefit by a little intensive research. Mr. Reid told him that the cowling work would continue.

EDITORIALS

AVIATION

EDWARD P. WARNER, *Editor*

Something for nothing?

FIND a real air transport enthusiast, and ask him a question. Ask him whether he thinks it most important in the transport plane of the future to have extremely high speed, or luxurious accommodations for the passenger, or the very highest degree of economy of operation. If he answers your question in terms corresponding to those in which it is asked the quality of his enthusiasm is suspect. For the real hundred-and-fifty-per-center, who has no inhibitions and who lets no law of God or man stand between him and his ideal, is likely to make reply that: "We want everything. The highest speed, *and* the greatest luxury, *and* the greatest economy, all in the same ship. And furthermore, we are just about to get them." That is what is called vision, and constructive optimism. The engineer who is expected to make good on all these proclamations of aggregated perfection is likely to have a less complimentary name for them.

Can we get something for nothing? In 1928 and 1929 there were several million Americans who thought so. It was fashionable to presume that the stock market could make everybody rich, and that the stock market could go steadily up to higher and higher levels without any reference to what was happening to the industries that the securities represented. But we saw our most holy illusions knocked higher than Gilderoy's kite, and in 1932 the stock market as a source of boundless wealth is at a discount.

Nevertheless the desire to get something for nothing persists. It pops up in new fields, and nowhere is it more pervasive than in aviation. It shows itself at its very best in the quest for performance.

Can we get speed without paying for it? No one has ever yet found the way. On land, through the water, and in the air, the power per unit of pay-load carried goes up with disconcerting rapidity as the speed is increased. Costs go along with power. That is, other things being equal. Of course, other things are sometimes far from equal, and times without number we have listened in on long and careful analyses of the comparative qualities of a fast and efficient airplane and those of a machine which was neither, culminating in the triumphal conclusion that speed is conducive to economy and that the faster you fly, the cheaper it is. It may be so, but if so it is opposed to all the experience that has ever been gained in any other form of transportation; it is opposed to everything that we can deduce about aircraft operations by theory; and it is opposed to the good old fundamental principle that you don't get anything without paying some kind of a price for it somewhere. Up to a certain point it may be well worth paying for, but let's not pretend to ourselves that the price is zero.

Laying aside for the moment the customary necessity of using higher power to get higher speed, can we introduce wholly new devices to improve aerodynamic efficiency without paying a price? There is a respectable school of opinion to tell us that we can. The retractable landing gear, for example, is being presented to us as pure velvet, as a sort of an aerodynamic manna from an engineering heaven. Surely it is a notable feature of many planes, and makes it possible to score impressive increases in maximum speed, but no one has yet discovered any way of making a retractable landing gear which does not add to the weight of the airplane, or to its first cost, or contribute a fresh maintenance problem. It may well be worth all that it costs, but it would be futile to pretend that it comes to us free of charge.

Can we make unlimited improvements in airport accommodations without paying the price? There is talk in some of our large cities of new airport developments to be constructed at figures running to twenty, forty, and even sixty million dollars. Some of them would be great blessings to air transport. Some of them would very likely be able to justify themselves economically. Unless there seems to be a prospect of their doing so they ought to be shunned, for it is not from a nice, kind, fairy godmother that these projects are to come, but from a more or less hard-headed public with a notable aversion to being stung in the pocketbook. Directly or indirectly, we of the aeronautical world and our immediate patrons will have to pay the bill for anything that we get. It is futile to suppose that we can evade it. The airplane must, as Mr. Stout has so often remarked, sustain itself economically as well as aerodynamically,—and it must do so in the broadest sense, taking all its charges into account.

There is a type of advertisement that is very popular in the shoddier sort of periodical and in Sunday newspaper magazine sections. It shouts: "BEAUTIFUL

BROOCH ABSOLUTELY FREE," in 48-point type, and the reader's cupidity is aroused to examine the offer further and discover that he has only to send a sum of money equal to twice the value of the promised article "to cover packing and mailing." One or two experiences with that sort of salesmanship makes the victim exceedingly gunshy, but we are in danger of playing the same trick on ourselves in aviation. We, too, are falling under the mystic spell of the gratuity. Spectacularly improved performance,—accommodations of unprecedented luxury,—all ABSOLUTELY FREE! Except in a very few instances, and in a very small way, the chances are it can't be done. The chances are that there is a catch in it somewhere. The builders and operators of aircraft have a vast deal to be proud of, but the inordinate degree of credulity that they sometimes display in respect of the willingness of natural law to accommodate itself to their desires is not among them.

Rumor, swift and evil-tongued

THERE is a parlor game. It calls for ten or fifteen people, and it has enjoyed brief spells of popularity in circles where psychology is a favorite study. The players sit about in a group, and one of them tells a brief but somewhat-involved story, of a very slightly scandalous nature, to his or her next-door neighbor. The recipient listens carefully, turns to the other side, and passes it on. It goes around the circle, and the game consists in trying to trace a similarity between the form in which it left the original narrator and the shape in which it gets back to him. Seldom, if ever, is the connection between the two apparent. Still more seldom does either the complexity or the scandal that marked the original account lose anything in the course of the circuit.

The aircraft industry is the scene of a similar pastime, but it is not played in the parlor. A says to *B*: "I hear the Cosmopolis Company only built three planes last month." B says to C: "I understand that Cosmopolis hasn't sold a plane in six months." C tells D: "Cosmopolis can't move anything, and all their capital is tied up in inventory." D tells E: "I just had a red-hot tip that the bankers are about to move in on the Cosmopolis plant." And so on, until by the time it gets to X, Y, and Z, the sheriff is already engaged in selling the factory and all its contents at auction for 2 cents on the dollar. The grapevine telegraph is an ancient means of communication and an extremely rapid one, but it is full of static and the messages that it carries are subject to very confused interpretation.

So much for philosophical introduction. Let us come to the point. Many times in the last two years we have been approached by friends, who have asked us with bated breath if we knew that one or more of the leading aircraft manufacturing companies or transport lines were just about to go on the rocks. As a general rule, we haven't known it. And we have thereupon been pitied for our ignorance, or reproached for being behind the times. We have been accused, more times than we like to recall, of excluding unfavorable news from print. We have been asked: "Why don't you print the facts,"—*facts*, mind you!—"about the collapse and reorganization of Interoceanic?" And it seems almost a pity to destroy an illusion by saying that we don't print them because they aren't so.

We don't in the least believe in withholding bad news. We quite agree that tendency to shrink from admitting anything of an unfavorable nature has been altogether too frequent in the aeronautical world. We have made it a rule to print the reports of all aircraft accidents which had any technical features of special importance or presented any special interest to the industry, and we shall continue to do so. We have printed the reports of a good many bankruptcies, and if any of the leading companies in the industry, or all of them, get into financial trouble, we shall print that. But, however often volunteer reporters may give us the information, and however warmly we may be urged to make use of it, we respectfully decline to print reports of débâcles that haven't happened.

It is one thing to recognize that there are rocks in the path ahead, or even to recognize that there are too many companies in the industry and that some of them must be eliminated. It is quite another to contribute to irresponsible panic by far-reaching allegations concerning the collapse of various specifically-named leaders of the industry. These stories start within the ranks of the industry itself. The damage that they do is not restricted to the companies against which they are directed. It is more widespread. They wreck morale within the industry, and confidence without. They increase the difficulty of finding customers for our products, and credit for the support of our activities. The desire to tell a good story is in almost every human being, but it may as well be recognized that those who launch good stories of this particular kind, or who contribute to enlarging upon them in the course of their travels, are embarked upon a course that lays an axe to the very roots of the stability of their own enterprises. If they were to be prosecuted, it ought to be not for malicious gossip, but for attempted industrial suicide.

Lo, the poor amateur, finds a friend

THERE is a section of the aircraft industry which has been devoting itself to a work of mortuary art. Upon a modest headstone they have engraved the epitaph: "SACRED TO THE MEMORY OF

PRIVATE FLYING. DIED, 1931. KILLED BY THE DOW-JONES AVERAGES." Unfortunately for their project, they haven't yet succeeded in catching up with the corpse.

Private flying refuses to participate in its own funeral. It really begins to look as though, at the time of the reported decease, there must have been a case of mistaken identification.

It looked very much that way at the Long Island Aviation Country Club one day last month. For private flying is supposed to be dead. We are frequently told that it was never anything but an illusion, and that it is now a shattered one. Yet 70 privately-owned planes, representing somewhere near a million dollars of total value, almost all of them piloted by their owner and bringing personal guests, landed at Hicksville on a single Sunday. The opening of the Philadelphia Country Club, a week later, brought together about as many. U. S. Steel common has gone from 260 down to 25, and Baltimore & Ohio from 145 to 3¾, but there are several hundred private owners who still manage not only to pay hangar rent and to buy gasoline to keep their ships extremely active, but even to purchase new planes every once in a while.

They form a large enough group to be of real importance to the aircraft industry. They are selling aviation to their friends, and they are paving the way to sell them airplanes. They are buying new ships for themselves. They are giving the sport of aviation a new social standing, and putting it into a new environment. They are entitled to the benefits of group action.

Sportsmen need group action just as much as labor unions. They have the same reason to recognize the advantages in increased bargaining power that are gained when a single organization can speak for all its membership. The private owner has often been regarded with a little scorn by the operating section of the industry, and especially by the professional pilot. As individuals, they have been unable to combat the slighting attitude which they sometimes encounter. Organized, they can fight for proper recognition and proper treatment in order that their individual activities may be carried on as pleasantly and as conveniently as possible.

The amateurs' need of an organization is obvious. Now they have it, in the Amateur Air Pilots Association. As the benefits of group action become more and more apparent, the triangle-bar insignia of the Association become more and more prevalent upon American flying fields.

To those who have been scarcely aware of the Amateur Pilots Association's existence, there will at once occur the objection that there has been too much diffusion of effort in American aviation and too many organizations formed already. It will be suggested that all this is a legitimate part of the work of the N.A.A. Unfortunately the precedents are all against any such view. Certainly the N.A.A. has a profound interest in the work done among the amateurs, and between it and the Amateur Association there should be the closest cooperation, but the N.A.A. has many interests outside of private flying, and experience in other sports brings almost unanimous testimony of the necessity of giving the amateur a distinct standing and an organization of his own. From shot-putting to steeple-chasing, with only four or five exceptions, amateur and professional sports, or the interest of the amateur and the interest of an industry, have been kept distinct. And where it has not been done, in most cases, the amateur spirit has languished and died. The time may come when airplanes will be sold to private owners as automobiles are sold today, for service and not for sport, and solicitude for the amateur pilot will no longer be necessary. For the present, private ownership must be fostered through sporting interest, and the Amateur Pilots Association has an important work to perform. Either from the point of view of the general good or from the most selfish outlook possible, an organization with the purposes professed by the A.A.P.A. deserves the support of all those eligible for membership.

Seven come eleven!

NOT long ago the writer had occasion to visit the manager of one of the country's major airports, a municipal field. It was on a Sunday afternoon and the field was fairly busy. The manager was not in his office, nor had he left word with attendants as to where he might be found, except that he was supposed to be somewhere along the apron. After a fruitless search lasting for more than twenty minutes it was thought wise to return to the administration offices for better instructions, or further suggestions. The information was finally vouchsafed that, if he could not be found anywhere else, the manager was probably ensconced in the rear locker room of the last hangar on the line. Right! He was safely hidden away in the locker room,—shooting dice with one of the mechanics.

Perhaps such democracy on the part of a field manager should be commended. Certainly the urge to "roll the bones" is a normal one, and easily understood. One wonders, however, if it would not have been possible to stage the crap game right in the manager's office, thus rendering him more or less accessible to those who might come to the airport with a serious purpose in mind, and so to some extent combining business with pleasure.

It should be unnecessary to remark in passing that this field is chiefly distinguished for the lack of success which has attended its administration. Strangely enough, too, the manager has had a great deal to say about the sad state of aeronautical affairs and about the impossibility of making both ends meet.

NEWS OF THE MONTH

A lady takes to the Atlantic

ONLY a few cows offered a none too cordial reception when Amelia Earhart Putnam landed in a pasture near Londonderry, Ireland, on May 21, thirteen hours and a half after leaving Harbor Grace. Her Lockheed Vega monoplane with its 500-hp. Pratt & Whitney Wasp engine set a new record time for the trans-Atlantic crossing, two hours and 42 minutes faster than the first non-stop flight, made by Alcock and Brown in 1919. Hers was the first feminine solo Atlantic flight, as well as the longest non-stop distance ever flown by a woman, 2,026.5 miles. Her flight with Wilmer Stultz and Lou Gordon as passenger on their flight from Trepassey to Burry Post, Wales, in 1928, also gives Mrs. Putnam the distinction of being the only person to cross the North Atlantic twice by airplane.

Close on the trail of the Lockheed with its single occupant flew the homing Do.X, manned by a crew of fourteen. After following a more southerly course for sixteen hours and 55 minutes the 100,000-lb. flying boat alighted on the water about seven miles off Horta in the Azores, where the NC-4 broke its journey in the spring of 1919. Its twelve Curtiss Conqueror engines, whose power output had been stepped up to 7,800 hp. in the course of their winter overhaul at North Beach, Long Island, had completely consumed the 7,000 gal. of gasoline with which it left Holyrood, Newfoundland. Only brief stops for refueling at Horta, Vigo, Spain, and Southampton interrupted the return flight, which terminated on Mueggel Lake, near Berlin, more than nineteen months after the departure of the Do.X from its home port on Lake Constance, Switzerland, to circle the Atlantic.

Lake Constance was recently the scene of test flights of the third gargantuan plane produced by the Dornier factory. Ordered by the Italian government which purchased the second Do.X, it is powered by twelve Fiat engines of about 590 hp. each, consuming 475 gal. of gasoline per hour. The seaplane weighs about 52 tons, reached a speed of 130 m.p.h., cost in the neighborhood of half a million dollars, exclusive of the power plants.

An air navigation agreement has been concluded between Germany and the United States defining the conditions under which civil aircraft of one country will be permitted to fly over the other. As in the agreement with Italy, signed last October, the acceptance by each country of certificates of airworthiness for aircraft exported from the other is provided for. The new understanding went into effect on June 1 and really free German-American trade in aircraft thus becomes possible for the first time.

Delegates disagree

The Naval Commission of the World Disarmament Conference, entrusted with the delicate problem of deciding what weapons should be abolished under qualitative disarmament, has been unable to get a unanimous verdict against the aircraft carrier on the three counts of its being specifically offensive, efficacious against national defense, and threatening to civilian populations. While a majority of the nations represented voted it guilty, Japan and the Soviet even to the extent of including in their opprobrium all warships capable of carrying aircraft, the United Kingdom, France and Argentina qualified their answers according to the type of aircraft carried, and the United States called the carrier innocent on all counts.

The American representatives on the Air Commission were also alone in their refusal to limit the size and weight of planes until their number also is restricted. The idea that the ultra-heavy bomber is a peculiarly grave menace to civilian populations is very widely accepted to Europe. In answer to the Belgian proposition, supported by most of the delegates, to fix the size, weight, and horsepower of planes which should be classified as offensive, meaning bombers, the Americans suggested a simultaneous restriction of bombing tactics and of the size and number of airplanes.

Calendar

June 24-26	International Air Pageant, formal opening of Aviation Country Club of Lake Champlain, Westport, N. Y.
June 25	13th Annual Royal Air Force Display, Hendon, England.
July 5-31	National Air Tour, starting from Detroit.
July 8-9	King's Cup Race, Brooklands Aerodrome, England.
July 8-11	Second Annual Aviation Country Clubs Invitation Seaplane Cruise.
July 10-16	Fourth Annual Michigan Air Tour, under American Legion auspices.
July 11-24	Third American Soaring Meet, Elmira, N. Y.
July 22-31	Third International Aeronautical Meeting, auspices Aero Club of Switzerland, Zurich.
July 28	Pre-Olympic Air Show, San Diego.
Aug. 1-6	International Soaring Contest, Wasserkuppe, Germany.
Aug. 11-28	International Air Tour, auspices Aero Club of Germany.
Aug. 19-21	Fourth Annual Canadian Air Pageant, St. Hubert, Quebec.
Aug. 27-Sept. 5	National Air Races, Cleveland.
Sept. 6	Aviation Day, National Travel Pageant, Atlantic City, N. J.
Sept. 25 or Oct. 8	Gordon Bennett Balloon Race, Basle, Switzerland.
Oct. 8-23	Aviation Exhibit, 46th Annual State Fair of Texas, Dallas.
November	Thirteenth Aeronautical Exhibition. Grand Palais, Paris.

Gliding and the F.A.I.

A technical commission on gliding recently formed by the Federation Aeronautique Internationale, will have as chairman Professor Georgii of Darmstadt and of the Rhon-Rossitten-Gesellschaft, guide, philosopher, and friend to German soaring pilots. Acting in an advisory capacity, the new group will study the problems of control of gliding and soaring as a sport and draft new regulations for the control of records. The United States' representative on the commission is Edward P. Warner, editor of AVIATION.

W. Hawley Bowlus, former American soaring champion and designer of soaring craft, is completing at Los Angeles a new sailplane for an attempt at soaring flight along the coast from San Francisco to Los Angeles. Regular monthly glider meets staged near Los Angeles by the American Glider Association, have resulted in widespread public interest and an increase in the number of soaring pilots. The association is working for an International Glider Meet on the Pacific coast next year.

The U.S.S. Akron, which has been on the Pacific coast since May 13, when it finally succeeded in making fast to the airship tender Patoka in San Francisco Bay, made a farewell trip to Tacoma, Seattle and other cities of the

northwest and then started its return flight to Lakehurst on June 4, following practically the same route as on the trip west to the Sunnyvale base.

The entire fleet of Goodyear non-rigid airships are being equipped with radio telegraph and telephone apparatus. The Puritan, at present in Florida, has just received its new equipment while the radio installations on the Defender, in service in the middle west, have been in use for some time, greatly facilitating its movements and effecting decided economy in operation.

Omaha drops the flag

The second annual Omaha Air Races, culminating in the National Balloon Race on May 30 gave the gun to the racing season. Russell Boardman, who with John Polando holds the world's distance record for their flight from New York to Istanbul last July, carried off the Charles Holman Aerobatics Trophy, and also gave Bennie Howard, whose white midget plane played a prominent part in the National Air Races of 1930 and 1931, stiff competition in the free-for-all speed event which Howard won by 90 yards.

Carrying firearms and a week's emergency rations against possible landings in the Canadian wilderness, six hydrogen-filled balloons took off from Omaha in a high wind to compete for the Litchfield Trophy and for the third place on the United States team for the International Gordon Bennett Trophy race at Basle, Switzerland, next fall. Ward T. Van Orman, winner of the last Gordon Bennett race, and Lieut. T. G. W. Settle, who piloted the winning Navy balloon in the National race last year, form the rest of the United States team. When the winning balloon, Army No. 2, piloted by Lieutenants Wilfred J. Paul and K. J. H. Bishop of Scott Field, came down at Hatton, Sask., after a flight of 900 miles it probably also set a new distance record for balloons of 35,000 cu.ft. capacity, though no official corroboration has been received. The previous record was 571 miles, set in 1927 by S. A. U. Rasmussen in a flight from Detroit to Hookerton, N. C. The Goodyear VII, piloted by Roland Blair, winner of the 1930 race, took second place, landing about 700 miles from Omaha.

Next on the program of summer events comes the National Air Tour, starting from Detroit on July 5 on a course which Ray Cooper, official pathfinder, and Jack Nevill have just covered experimentally. The trail to be followed for four weeks will lead through Milwaukee, Minneapolis, Sioux City, Tulsa, Little Rock, Birmingham, Atlanta, Atlantic City and Pittsburgh. An innovation of the present tour will be air shows of from three to five days' duration at Minneapolis, Tulsa, Atlanta, Atlantic City and at Detroit before the start. The forthcoming Tour will be the eighth annual repetition of the event.

The National Air Races at Cleveland late in August will feature two new events. A transcontinental sweepstake handicap air derby, the Cord Cup Race, sponsored by E. L. Cord and for which Cliff Henderson has recently completed the pathfinding tour, offers to the winners, in addition to cash prizes, two automobiles and possession of the cup. Frank Phillips is responsible for a free-for-all event for planes with engines of 800 cu.in., the winner of which will be awarded the Woolaroc Trophy and $2,500. Of interest to sportsmen pilots is the handicap derby to be flown from Roosevelt Field to Cleveland for the trophy and prizes established by William B. Leeds and open to all pilots flying A.T.C. or Group II planes.

To replace the stimulus which the Schneider Trophy races, the last of which was held over Calshot last September, provided for the development of aircraft and engines, the Aero Club of France has reorganized the Coupe Deutsch de la Meurthe, named for its late president. The contests, to be held in France every two years beginning in 1933 will be international in scope, open to all comers. The only conditions imposed upon entrants are a limitation of the size of the engines to 8 litres, or 488 cu.in., of piston displacement, and the requirement that they demonstrate a speed of at least 125 m.p.h. in trials before the race. While engines of the specified size at present develop only 100-150 h.p. the French authorities expect that the contest will be incentive to research to bring up to 300 hp. the output of this type of power plant. The course specified implies considerable range as well as speed in the planes entered. Starting together, contestants will fly 625 miles on a closed circuit of 60 miles or more, and after an hour for refueling repeat the flight. The first plane across the finish line the second time will win 100,000 francs and possession of the trophy until the next contest. The previous Coupe Deutsch, awarded in an unlimited speed event for landplanes languished and died some eight years ago.

Amateurs take the stick

The London *Morning Post's* novel race, flown from Heston Aerodrome on May 21, owing to the exigencies of English weather, proved to be practically a contest in blind flying. The winner, who averaged 108 m.p.h. in his Puss Moth, passed several of his competitors en route without seeing them.

The opening of the Philadelphia Aviation Country Club on May 22 at Wings Field, near Chestnut Hill, was the occasion for an air meet attended by 65 planes, almost all of them privately owned. In addition to aerial exhibitions and aerobatics an interclub competition was held with each club represented by a team of three pilots. Long Island Aviation Country Club held its annual spring air meet on May 15 at its Hicksville field with a program of races and technical competitions, with 70 privately-owned planes in attendance, and with some 300 or 400 luncheon guests, almost half of whom came in by air—probably the best turnout of purely amateur aviation that has ever been held in the United States.

An agreement between the United States Amateur Air Pilot's Association and Barber & Baldwin, insurance underwriters, removes another handicap from the extension for sport flying in this country. Under policies now to be be available for amateur pilots, the drastic restrictions formerly placed on flying after dark, over water and more than 50 miles beyond the territorial borders of the United States are removed. In addition, amateurs may operate each others' machines without

N.A.C.A.

ENGINEERS TALK IT OVER

The engineers who participated in the Seventh Annual Aircraft Engineering Research Conference of the National Advisory Committee for Aeronautics at Langley Field, Va.

invalidating the insurance, for coverage applies whether the plane is flown by its owner or by another pilot holding an approval card—to be issued gratis by the underwriters.

Annual publication of the latest statistics on mortality among all classes of airplane pilots and passengers, civil, military and naval will be undertaken by the Dillon Publishing Company under the editorship of Capt. Ray A. Dunn of the Army Air Corps. The current study, published on June 15 under the title "Aviation and Insurance," covers the years 1919 to 1931 inclusive and is a continuation in more detailed from of a study of the same name written by Captain Dunn in 1930 and published and distributed by the Daniel Guggenheim Fund for the Promotion of Aeronautics.

Parks Air College, together with the St. Louis Chamber of Commerce Air Board, is offering encouragement to prospective pilots in the form of twenty resident scholarships to recent high school graduates in the trade territory of St. Louis. Ten seven-and-a-half month courses and ten ten-week courses in the air college will be awarded annually through an essay contest, with several additional scholarships for post-graduate work in the Master Mechanics' School.

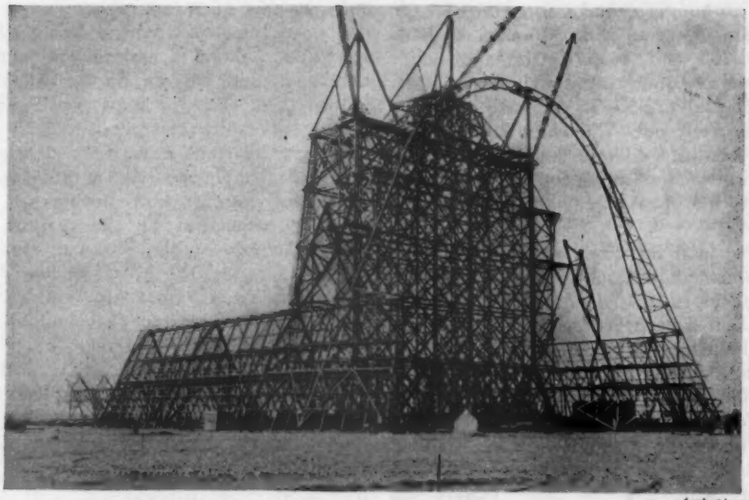
The Kinner Airplane and Motor Corporation has announced its entrance into the field of aircraft manufacture with a folding low-wing two-place monoplane designed by W. B. Kinner. It will be powered with a 100-hp. Kinner engine, while the four-place cabin plane developed by Robert Porter and next on the production program, will have the Kinner 210-hp. power plant.

Jacobs moves

The Jacobs Aircraft Engine Company of Camden, N. J., has transferred all its manufacturing operations from Camden, N. J., to Pottstown, Pa., where it has acquired the manufacturing plant formerly occupied by the Light Manufacturing and Foundry Company. The new quarters provide a considerable increase in space and manufacturing facilities.

The Irving Air Chute Company is now installed in its new factory and offices at 1670 Jefferson Avenue, Buffalo, where improved production facilities and additional space are available. Operations, which were suspended for several weeks after the move, have been resumed.

Sales effort is being extended by several firms. Pitcairn Aircraft has appointed the Pal-Waukee airport near Chicago as distributor and servicing center for Illinois. Thompson Aeronautical Corporation has added Midwest Airways, operating a repair shop at the Milwaukee county airport, to its chain of sales and service organizations. Aircraft and engine overhaul bases are maintained in seven middle western states by Thompson Aeronautical, which is the ground organization of Transamerican Airlines.



Aviation

SPINNING A GIANT WEB

The Navy's dirigible hangar at Sunnyvale takes shape. The first truss is in place and work on the second is under way.

Corporation reports

With understandable reluctance, reports for the year 1931 continue to come in. Bad as conditions are, most of the reports show the effects of drastic reduction of expense in a cutting of losses. The General Aviation Corporation submits a deficit of $2,232,735, to be compared with a deficit of $2,133,858 for 1930. Net losses from operations during the past year were only $861,819, but $1,370,916 had to be added to cover write-down of inventories to current market values and charging off of deferred experimental expenses. During the year 60,000 shares of Western Air Express stock were secured by General Aviation (formerly Fokker Aircraft Corporation of America), which now concentrates at the Baltimore Municipal airport the manufacturing activities previously carried on at Glendale, W. Va., and at Hasbrouck Heights and Passaic, N. J.

Curtiss Aeroplane and Motors Company, which is controlled by the Curtiss-Wright Corporation, reports a net loss after depreciation, amortization, expenses, inventory adjustments, idle plant costs and other charges of $456,797 for 1931, as contrasted with a net profit of $555,003 for the previous year.

Operations of the Aviation Corporation and subsidiaries continued unprofitable in the first quarter of 1932. Net loss after depreciation, expense of the parent company, liquidation of flying equipment and sale of securities was $823,872, as compared with $334,436 loss last year after depreciation, expenses and apportioning of the losses of controlled companies not consolidated.

Net loss of the Fairchild Aviation Corporation for the past year was $95,424 after expenses, inventory adjustments, development costs, minority interest, depreciation and other charges. For 1930 the company sustained a net loss of $871,522, after expenses and other charges and including a profit of $220,409 on the sale of stock of the Aviation Corporation.

Airlines save time

In much brighter colors is painted the air transport picture of new planes, new routes and new schedules. United Air Lines, which already have a service to the Pacific Coast in one business day and only slightly more than 24 hours, plans to reduce the time to 23 hours or even less with a fleet of 60 new transport planes recently ordered from the Boeing Airplane Company, another United subsidiary. The twin-engined transports, modeled on the new type bombers just delivered to the Army Air Corps, and powered with Pratt & Whitney Wasps of 600 hp. will carry ten passengers, 500 lb. of mail and express and two pilots at a cruising speed of more than 150 m.p.h. The New York-Chicago run will be cut down to five hours and schedules to the Southwest speeded up by the new all-metal planes. A 500-mile range is to make possible the elimination of many stops for refueling. An investment of $2,000,000 is represented by this new equipment.

Ludington Airlines have added to their regular "every-hour-on-the-hour" schedules between New York and Washington a fast non-stop service reducing the flying time between the two cities to 80 minutes. Consolidated Fleetsters, powered with 650-hp. Wright Cyclone engines and carrying

nine passengers, make four trips daily in each direction at 7:30 and 9:30 a.m. and 2:30 and 4:30 in the afternoon. One way and round trip fares are $13.25 and $22.50, an increase of about 15 per cent over the rates on the regular service. These additions to the schedule make Ludington the most frequent air passenger service in the world.

American Airways, upon completion of intermediate landing fields along the route, on June 4 inaugurated passenger service between Atlanta, New Orleans and Houston. The route has had direct air mail service for some time. Stinson tri-motors cut the time from Atlanta to New Orleans to less than five hours, and make the through trip to Houston in nine. The inauguration of night flying schedules on the Dallas-San Diego-Los Angeles route offers another saving of time. Now passengers leaving New York by train make connections at Columbus or Cleveland which bring them to Dallas at 6:28 p.m. and Los Angeles at 7:00 the next morning. A second night of rail travel previously prolonged the journey several hours.

Arrangements recently completed between American Airways and the Western Union Telegraph Company provide for the sale of airline reservations at all Western Union offices. Similar arrangements were concluded some time ago with Postal Telegraph, which acts for a large number of the airlines.

With the coming of spring, services were expanded on Transamerican Airlines. Passenger service was resumed on the Chicago - South Bend - Fort Wayne route, which during the winter handled mail only. Service on the Detroit-South Bend-Chicago route has been increased from seven to nine planes, with an additional schedule each way, from Wednesday through Saturday of each week. Pennsylvania Air Lines operate an additional air mail schedule at night on their route from Washington to Cleveland connecting there with the transcontinental route and giving the Capitol faster service to Chicago and points west.

A day nearer South America

Air mail service between cities on the eastern seaboard and the West Indies and Central and South America has been shortened almost a day by a change in the schedule and route of the planes flown by Eastern Air Transport from New York to connect with the foreign air mail at Miami. A 5-p.m. plane from New York is now operated over the coastal airway through Raleigh, Charleston and Savannah instead of by way of Atlanta, and reaches Miami in time for the same connection as a previous plane leaving New York at 9 p.m. the day before. Nineteen hours are saved by the new schedules which bring Barranquilla, Colombia within one and a half days and Bogota, in the interior, within three days of New York. The transit times by steamer and rail are seven and thirteen days, respectively.

Upon completion of arrangements with the immigration authorities to conduct inspection at the airport at Nuevo Laredo on the Mexican side of the Rio Grande, the Mexico-Cuba Airways will inaugurate a nine-hour service between Mexico City and San Antonio. The same Bellanca, Fairchild and Ford planes which since February last have been flying a daily service between Mexico City and Nuevo Laredo with three intermediate stops will be used on the through route.

Summer service abroad

Further afield, the same activity is evident. The summer time-table of Imperial Airways provides regular daily air connection between London and 130 European cities. K.L.M., which during the winter varies its course across central Europe with weather conditions, now stops regularly at Budapest and Athens en route to Batavia. With the initiation of two Lockheed Orions into the services of Swissair the round trip between Zurich and Vienna is made in a single day, with several hours to spare. When the season for air transportation opened in Soviet Russia on May 15 eleven new airlines commenced daily operation. Night service is being established on the four lines connecting Moscow with Baku, Irkutsk, Sverdlovsk and Rostow. The new Soviet tri-motor ANT-9 planes are used except on the mail and passenger routes from Leningrad and Moscow to Berlin, on which Junkers planes are flown, covering the distances in fourteen to fifteen hours. Berlin and Paris are brought within a day's flight of Athens by the agreements concluded between the Greek Air Transport Company, the Deutsche Luft Hansa and the International Air Navigation Company. Service was to begin on May 15, the planes of the Greek company flying the part of the route between Thessaloniki and the Greek capital.

The Deutsche Luft Hansa ship-to-shore service from two trans-Atlantic vessels of the North German Lloyd has been resumed. From one a Heinkel H.E. 58, and from the other a Junkers W34, is catapulted some 700 miles off shore, making possible the delivery of mail in California five days after its dispatch in Europe.

Trans-Atlantic airline in sight

Trans-Atlantic airlines have been the chief subject of discussion at the International Congress of Transoceanic Fliers called at Rome by the Italian Aero Club on May 22 and attended by about 50 pilots. Detailed reports of his experiences were made by each transoceanic veteran for the use of committees appointed to study the problem of establishing regular airlines across the North and South Atlantic. While two alternatives for the northern route are still largely matters of discussion, definite steps have been taken by three countries to start operation of a southern line. The Aeropostale company (French) plans to make experimental monthly trips at the period of each full moon beginning in July, from Toulouse to Rio de Janeiro, while three steamers cruise about the route to secure weather data for the planes. They planned the same thing in 1930, but laid the project aside after one successful flight and one unsuccessful. Deutsche Luft Hansa projects a service between British Gambia and Natal this fall, stationing a steamship in mid-ocean as fueling station for the improved Dornier-Wal seaplanes which will be used. The proposed Italian route is from Portuguese Guinea to Parahyba, Brazil.

Personnel

Luther K. Harris, superintendent of maintenance on the Ludington Lines since their inauguration in 1930, and active in the operation of the Nyrba lines until their absorption by Pan American, was recently appointed assistant to the President of American Airways, to have charge of maintenance on the entire system. Mr. Harris, a frequent contributor to AVIATION, has been connected with aviation since 1917, and entered commercial flying as a mail pilot in the employ of the Post Office Department in 1930.

Maj. E. E. Aldrin, aviation manager of the Standard Oil Company of New Jersey and for many years active in the development of standardized petroleum products for aircraft engines, has been elected President of the Stanavo Specification Board, Inc., for the formation of which he was largely responsible.

Aubrey Keif, formerly manager of the Curtiss-Wright Oklahoma City base and western sales manager for the Curtiss-Wright Flying Service, has been appointed aviation representative of the Texas Company in the Middle West.

The Beech Aircraft Company, which starts production shortly on its Beechcraft, high-speed planes for the owner-pilot, has as its chief engineer Ted Wells. Mr. Wells was associated with Walter Beech, organizer of the company, in his previous work with Curtiss-Wright.

Blensoe Payne and Daniel L. Boone, erstwhile Century Air Line pilots, have been added to the flying personnel of Transamerican Airlines Corporation on its South Bend-Fort Wayne and Chicago-Bay City routes.

SIDE SLIPS

By Robert R. Osborn

THE recent advertising of the Autogiro Company has been headed by the question "What happens if the engine quits?" Thanks to W. W., Jr., of Peekskill, N. Y., we can give the answer, which is: The pilot will be in a "tough spot" and he will be lucky if he escapes a lynching by the outraged natives of America's backwoods. The following is from the Peekskill *Evening Star:*

"GYROSCOPE CAUSES STIR AT INDIAN POINT. At Indian Point Sunday, the sudden descent of a gyroscope making a forced landing caused considerable excitement. Several narrowly escaped injuries as the crowd at a ball game scurried out of the way. The pilot, 'Swede' Peterson, of the Curtiss Airport at Valley Stream, L. I., narrowly escaped being mobbed by the enraged crowd, and Chas. T. Olcott, of the Hudson River Day Line, who happened to be at the point, which his company owns and operates, sent a call to the Buchanan village police. Chief William Gilman, who had noted the gyro descending, was already on his way. On his arrival it was a moot question of what charge to make against Peterson, and after he had received numerous highly charged solo and chorus bawlings out he was allowed to go on his way with the stern admonition to keep far away from Indian Point in the future."

Apparently, flying these here, now, gyroscopes is more dangerous than we had been led to believe, and we suggest that any readers who might be considering buying one, insist that a sawed-off double-barreled shot-gun be made standard equipment.

Mr. E.P.W. has called our attention to an "addition to the life of tragedies complete in one sentence." A gentle-

man wrote in to inquire, "Do you know where I can trade a very good home-made light plane for flying lessons?"

"TRANS-SEA FLIER'S CONGRESS ENDS IN ALL-NIGHT WRANGLE"—headline in Buffalo *Evening News* describing the meeting of Trans-Atlantic pilots in Italy recently.

Each day new uses for aircraft are brought out in the daily press, so that one might think their uses were limitless. However, a number of flights which were made ostensibly for just that purpose have proved definitely that aircraft are worthless for "promoting amity between nations."

"The Imperial Airways four-engined biplane Horatius, which left Croydon on the 12.30 hours service for Paris on May 9, was nearly struck by lightning a few miles out, somewhere over Tonbridge. At the time the pilot, Mr. O. P. Jones, was in the middle of a cloud at 2,000 feet, in the course of taking his thirteen passengers to the sunshine and calm air above the dreadful weather of Southern England. The lightning fused the trailing wireless aerial, burned out the wireless installation and caused enough disturbance in the nose compartment to blow a window out. Neither of the two pilots nor the wireless operator in the nose compartment felt any bad effects, other than presumably a mild surprise. And the passengers knew nothing at all about it."—from *The Aeroplane.*

An American pilot wouldn't have been even mildly surprised. He would have expected just what happened, and would have sent a note to the airplane manufacturer asking why airplanes couldn't be built so that the windows wouldn't be knocked out by a little lightning.

The conservatism of *The Aeroplane* reporter, in saying that the airplane "was nearly struck by lightning" reminds us of a statement made to us by the famous Mr. Levine, after a really remarkable flight at Roosevelt Field on Long Island, which statement we believe represents the farthest north in conservatism. He had made a really amazing take-off with his Bellanca monoplane "Columbia,"—after running what he thought to be sufficient distance he attempted to pull the ship off, but it had not yet attained flying speed. It settled down on one wheel and a wing tip and swerved at right angles to its original course. It straightened out momentarily and another attempt was made to pull it off, and again it settled down on the same wing tip, the same wheel and also dragged the elevator on the ground. This swerved the ship another 90 deg. and it finally got off down wind and just cleared the hangar into which we were running as fast as we could. After a short flight around the fields there, Mr. Levine made three "passes" at the field before he obtained an approach which suited him. The landing which followed was on the other wing tip and the other wheel, and was, unfortunately, on the wrong side of a very substantial wooden fence which separated the automobile parking space from the field proper. That wing tip and wheel were torn off, and the ship then ground-looped violently, breaking the other wing tip, and finally stood on its nose, breaking the propeller. We rushed up, as Mr. Levine stepped out very jauntily, and inquired "What happened, Mr. Levine?" He said, "I thought that take-off was bad, but this landing was much worse."

The headline of an advertisement in a recent issue of our favorite aeronautical magazine startles us: "Is your airport one of the thousand that disappear at night?" We hadn't known that this

sort of thing was going on, but we suppose that the incarceration of Mr. Alphonse Capone will probably help to clear up the matter. Considering the recent writing-down of airport valuations by some of the larger aeronautical companies, we suppose that this sort of pilferage would be classed as petty larceny.

The Intrepid Aviator dropped in to see us today for the first time in a long while. Between puffs on one of our cigars he remarked that he was surprised that Amelia Earhart should have been worried when one of the exhaust stacks fell off her airplane during her recent trans-Atlantic flight. He says that the exhaust stacks on his Jenny fall off regularly, one every half hour, and he finds that a very convenient way of keeping track of the time of each flight. When only four stacks are left, it is time to look around for a smooth cow pasture.

"MANUFACTURERS MAKE HAY"—headline in AVIATION for June. Some others are making radio cabinets, some are growing mushrooms in their dark store-rooms, some are running storage warehouses, but most of the airplane manufacturers have just closed up their plants completely.

STATISTICS OF THE MONTH

Supplementing the statistical issue of AVIATION, *March, 1932. Page numbers refer to that issue.*

AIR MAIL

(page 107)

Analysis of the records of air mail carried on contract routes in the United States during the first three months of 1932 shows a decided improvement over the previous year, despite the current depression in all lines of business. The apparent drop in total mail poundage carried represents the effect of a change in routing, which if it could be applied to 1931 figures would reduce them considerably. Mail between Los Angeles and the Atlantic coast, now flown over route 34 and counted but once in the total, last year was carried as a rule over routes 17, 18 and 4—New York to Chicago, Chicago to San Francisco, and Salt Lake City to San Diego—and counted two or three times in the summary of poundage. The discrepancy involved in this instance is many times the apparent decrease of 32,000 lb.

Mileage scheduled and actually flown over domestic air routes has increased by almost half the 1931 figures, and the amount paid to contractors is 12 per cent greater than it was for the same period of last year. At the same time there has been a decided decrease in the rate of compensation, the new transcontinental route between New York and Los Angeles, which had been in operation only a few months at the beginning of 1931, presenting almost the only instance of an increase in the compensation per mile flown as compared with last year.

Air Mail Carried by Routes

(First Quarter, 1932)

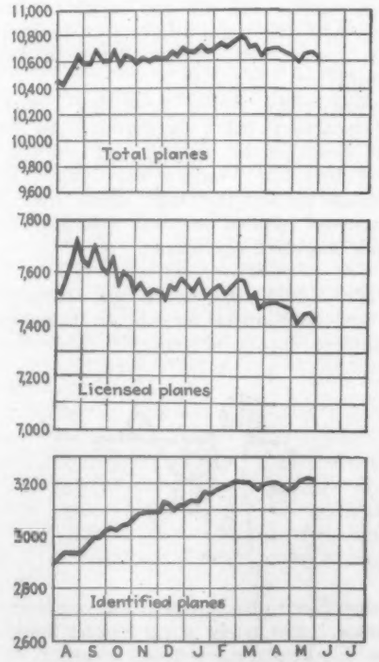
	Miles of service		Total weight of mail dispatched (pounds)		Amount paid to contractor	Average compensation per mile flown
American Airways	Scheduled	Actually flown	1932	1931		
1. Boston-New York	65,612	52,602	26,928	30,742	$29,417.36	$0.56
2. Chicago-Memphis	143,842	122,871	13,742	15,594	72,837.62	0.59
20. New York-Fort Worth	493,503	385,478	54,452	29,095[1]	224,450.73	0.58
21. Dallas-Galveston	62,107	56,487	8,408	9,080	29,317.15	0.52
22. Dallas-Brownsville	100,895	97,324	21,729	20,528	57,070.70	0.59
231. Atlanta-New Orleans	83,480	80,489	23,556	24,598	34,442.42	0.43
24. Chicago-Cincinnati	100,068	82,632	14,032	24,853	46,432.21	0.56
29. New Orleans-Houston	59,150	58,532	11,399	12,737	24,098.47	0.41
30. Omaha-Atlanta	335,540	283,501	71,912	79,236[2]	152,297.11	0.54
33. Atlanta-Los Angeles	568,820	526,245	68,434	50,216	450,073.51	0.86
Total	2,012,017	1,746,161	314,592	296,679	$1,120,437.28	0.64
Eastern Air Transport						
19. New York-Miami	921,926	838,160	248,723	241,077[3]	407,219.26	0.49
National Parks Airways						
26. Great Falls-Salt Lake City	185,530	173,139	12,331	13,748	88,452.36	0.51
Northwest Airways						
9. Chicago-Pembina	397,745	371,986	61,279	60,686	208,215.16	0.56
Pennsylvania Air Lines						
11. Washington-Cleveland	168,347	112,240	23,526	14,805	43,748.60	0.39
Transamerican Airlines						
27. Bay City-Chicago	377,749	308,091	40,940	40,987	138,765.66	0.45
Transcontinental & Western Air						
34. New York-Los Angeles	1,159,981	998,796	347,627	51,651	741,680.27	0.74
Western Air Express						
4. Salt Lake City-San Diego	143,630	138,183	17,132	201,117	60,419.74	0.44
12. Cheyenne-Albuquerque-Amarillo	156,884	139,032	28,684	18,289	76,405.73	0.55
33. Albuquerque-El Paso	40,626	38,562	1,729	.....[4]	30,551.28	0.79
Total	341,130	315,777	47,545	219,406	167,376.75	0.53
United Air Lines						
3. Chicago-Dallas	444,153	376,639	129,027	107,290	239,492.95	0.64
5. Salt Lake City-Seattle	320,343	291,994	73,765	77,871	183,976.62	0.63
8. Seattle-San Diego	445,330	419,910	111,561	85,514	241,971.79	0.58
17. New York-Chicago	553,068	465,598	315,378	379,907	307,198.77	0.66
18. Chicago-San Francisco[5]	1,146,850	1,080,980	291,957	465,040	777,863.86	0.72
Total	2,909,744	2,635,121	921,688	1,115,622	$1,750,493.99	0.66
United States Airways						
30. Kansas City-Denver	99,008	86,149	4,099	.....[6]	33,598.11	0.39
Total	8,574,187	7,585,620	2,022,350	2,054,661	4,699,987.44	0.62

[1]Includes route 16 with which it consolidated June 1, 1931. [2]Includes route 28 with which it consolidated May 15, 1931. [3]Includes route 25 with which it consolidated April 1, 1931. [4]Inaugurated Aug. 1, 1931. [5]Inaugurated June 5, 1931. [6]Service between Omaha, Neb. and Watertown, S.D. inaugurated Jan. 16, 1932.

FOREIGN TRADE

(page 129)

IN ITS export trade the aeronautical industry fared no better than the general run of business during the first quarter of the current year. The total value of aeronautical exports dropped 38 per cent as compared with the same period of the previous year, practically the same decline as recorded by the total value of all exports from the United States, and attributable to some extent to the de-



Valid airplane licenses and identifications

Aeronautical Exports

(First Quarter, 1932)

	Total Value	Airplanes No.	Airplanes Value	Engines No.	Engines Value	Accessories Value
Canada and Newfoundland	**$55,898**	**2**	**$20,953**	**8**	**$2,812**	**$32,133**
Mexico and Central America*	**99,215**	**11**	**47,910**	**21**	**32,678**	**18,627**
Guatemala	984	..	.....	1	450	534
Honduras	5,589	2	5,100	..	.....	489
Nicaragua	700	..	.....	..	.....	700
Panama	10,530	..	.....	2	5,000	5,530
Mexico	65,206	9	42,810	15	18,600	3,796
Trinidad and Tobago	8,866	..	.....	2	6,078	2,788
Cuba	4,451	..	.....	..	.....	4,451
Republic of Haiti	2,859	..	.....	1	2,550	309
South America*	**93,297**	**7**	**46,382**	**4**	**9,533**	**37,382**
Argentina	400	..	.....	..	.....	400
Bolivia	2,702	..	.....	1	1,900	802
Brazil	67,393	6	46,181	..	.....	21,212
Chile	1,033	..	.....	..	.....	1,033
Colombia	5,729	..	.....	2	4,123	1,606
Ecuador	201	1	201	..	.....	.....
Peru	11,140	..	.....	..	.....	11,140
Venesuela	4,307	..	.....	1	3,500	807
Europe*	**317,826**	**4**	**98,850**	**32**	**153,591**	**65,385**
Belgium	63,724	2	48,850	2	13,770	1,104
Czechoslovakia	11,159	..	.....	..	.....	11,159
Germany	67,271	2	50,000	3	14,813	2,458
Italy	965	..	.....	..	.....	965
Latvia	10,400	..	.....	5	10,400	.....
Netherlands	84,094	..	.....	16	77,755	6,339
Soviet Russia in Europe	30,368	..	.....	..	.....	30,368
Spain	870	..	.....	..	.....	870
Sweden	42,036	..	.....	6	36,853	5,183
United Kingdom	6,230	..	.....	..	.....	6,230
Asia*	**193,356**	**2**	**105,193**	..	.....	**88,163**
China	27,954	..	.....	..	.....	27,954
Other Dutch East Indies	4,342	..	.....	..	.....	4,342
Hong Kong	85,560	1	84,793	..	.....	767
Japan	73,229	1	20,400	..	.....	52,829
Siam	2,135	..	.....	..	.....	2,135
Oceania*	**45,795**	**6**	**38,339**	..	.....	**7,456**
Australia	676	..	.....	..	.....	676
Philippine Islands	39,228	1	32,500	..	.....	6,728
Africa†	**1,057**	..	.....	..	.....	**1,057**
Total	**$806,444**	**32**	**$357,627**	**65**	**$198,604**	**$250,213**

*Total includes exports to miscellaneous other countries on the continent not included in the breakdown.
†Union of South Africa and Egypt.

Airplane and Engine Production

(First Quarter, 1932)

	1931 No.	1931 Value	1932 No.	1932 Value
Airplanes	**552**	**$4,807,564**	**343**	**$3,701,121**
Commercial	295	1,370,934	135	633,917
Biplanes	88	.....	46	*194,914*
Monoplanes	191	.....	74	*340,885*
Amphibions, etc.	9	.....	7	*48,618*
Autogiros	7	.....	9	*49,500*
Military	257	3,436,630	208	3,067,274
Engines	**876**	**3,122,169**	**563**	**2,787,790**
Commercial	435	855,925	191	622,790
Military	441	2,266,244	372	2,165,000
Total	...	**$7,929,733**	...	**$6,488,961**

Figures from the Aeronautical Chamber of Commerce

cline in commodity prices. While airplanes exported increased in both number and value by more than 10 per cent, exports of engines and accessories were valued at barely half the previous year's figures, largely due to a $300,000 order placed by Soviet Russia in the first quarter of 1931. Its purchases in the current quarter were of accessories only, and valued at one-tenth that amount.

Closely following Hong Kong, whose purchase of a single expensive airplane gives it first position on the list of buyers for 1932, comes the Netherlands, by virtue of heavy purchases of engines for use in the planes of the K.L.M. Japan, Brazil, Germany, Mexico and Belgium are next in order of their purchases, with Canada, which occupied second place on the 1931 list, well to the rear. Chile and the United Kingdom, both important buyers last year, have also dropped to positions of negligible importance.

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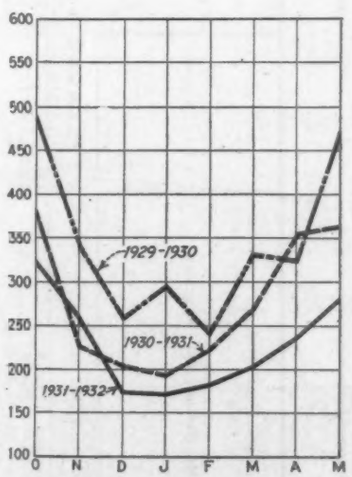
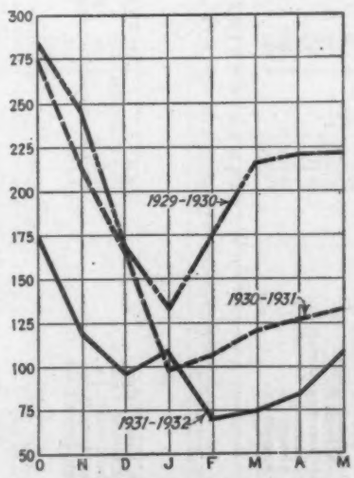
PRODUCTION AND LICENSING

(pages 118-128)

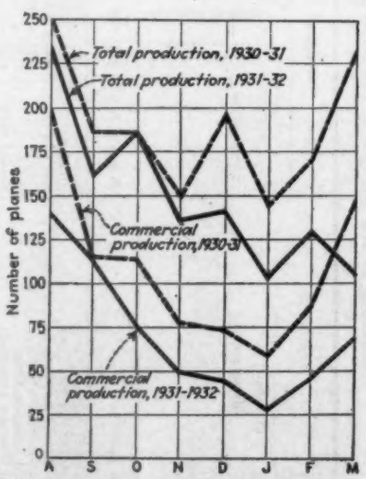
THOUGH the number of commercial airplanes and engines produced during the first quarter of 1932 is barely half the previous year's figure, military production reduces the total decrease to about 38 per cent below the first quarter of 1931. An increase in unit value, especially marked in the case of engines, accounts for the smaller decreases in values of total production which were only 23 and 11 per cent for airplanes and engines respectively, less than the drop in general price levels.



Average weekly issuance of student permits



Average weekly issuance of pilot licenses



Seasonal curves of commercial and total airplane production

American airplane specifications

Additions to and changes in the table published in AVIATION for January, 1932—AVIATION does not assume responsibility for the figures given

Manufacturer	Designation	General: A.T.C. number	General: Price at factory	General: Type	General: Number of seats	Power Plant: Make of engine	Power Plant: Total rated hp.	Power Plant: R.p.m. at rated hp.	Power Plant: Fuel capacity (gal.)	Power Plant: Normal range	Power Plant: Fuel consumption at cruising speed (gal. per hr.)	Power Plant: Diameter of propeller (in.)	Weights: Wing loading (lb. per sq.ft.)	Weights: Power loading (lb. per hp.)	Weights: Weight empty with cooling water if used	Weights: Payload (lb.)	Weights: Gross weight (lb.)	Performance: High speed (m.p.h.)	Performance: Cruising speed (m.p.h.)	Performance: R.p.m. at cruising speed	Performance: Stalling speed (m.p.h.)	Performance: Climb at sea level (f.p.m.)	Performance: Service ceiling (ft.)	Performance: Performance basis
PASSENGER PLANES WITH SEATS FOR FEWER THAN FOUR PERSONS																								
Consolidated Aircraft Corp.	Model 8	428	5,585	OBL	3	K	125	1,925	39	475	7.8	96	10.20	16.00	1,300	250	2,000	115	95	1,780	55	520	10,000	Ms
Consolidated Aircraft Corp.	Model 9	428	5,185	OBL	2	K	125	1,925	39	475	7.8	96	10.10	15.70	1,278	240	1,967	115	95	1,780	55	540	10,400	Ms
Curtiss-Wright Airplane Co.	Sport 16-E	463	4,600	OBL	3	Wr Ww	165	2,000	33	360	10.5	102	10.40	13.00	1,357	395	2,150	135	115	1,800	48	1,600	18,000	Ms
Fairchild Aviation Corp.	22-C7B	483	3,450	OLM	2	Men	125	.....	.....	430	.....	.....	9.30	12.80	1,010	.....	1,600	125	106	.....	44	1,050	20,000	Ms
Fairchild Aviation Corp.	24-C8	475	3,360	CML	2	Cir	95	.....	24	350	.....	.....	9.40	16.80	1,030	.....	1,600	114	94	.....	48	700	12,000	Ms
General Western Aero Corp.	Meteor P-2S	482	.....	OML	2	K	100	1,810	32	420	8.0	91	10.70	17.50	1,137	228	1,750	130	105	1,700	40	1,200	.....	Ms
Heath Aircraft Co.	LNB-4	456	1,074	OML	1	Heath	25	2,800	9	250	2.4	57	5.16	28.00	450	0	700	71	60	2,450	40	300	9,000	Ms
Heath Aircraft Co.	LNA-40	487	1,224	OML	1	Con	37	2,550	9	250	2.9	60	5.16	18.90	459	0	700	80	70	2,300	40	500	12,000	Ms
Nicholas-Beasley Airplane Co.	NB-8G	452	1,790	OML	2	Ge	80	2,310	21	425	4.2	.....	6.65	15.10	717	493	1,210	110	95	1,950	42	750	18,000	Gt
Rearwin Airplanes, Inc.	Junior 4000	469	.....	OLM	2	Aero	50	.....	.....	400	2.8	.....	5.55	22.50	525	.....	1,025	100	85	.....	.....	700	.....	Ms
Taylor Aircraft Co.	Cub E-2	455	1,325	OML	2	Con	37	2,550	9	200	2.5	64	5.40	25.00	525	170	925	78	65	2,200	.....	500	10,000	Ms
United-Stearman Aircraft Co.	6-H	458	.....	OLB	2	K	210	1,900	66	700	10.4	108	10.10	13.00	1,893	230	2,727	120	100	1,750	49	880	14,650	Ms
United-Stearman Aircraft Co.	6-L	459	.....	OLB	2	Ly	215	2,000	63	650	10.6	108	10.10	12.80	1,952	235	2,749	120	100	1,750	52	820	12,575	Ms
Waco Aircraft Co.	KBA	460	3,585	O, CBL	2	K	100	1,900	40	500	6.0	.....	8.21	19.85	1,259	341	1,985	101	86	1,750	40	425	10,500	Ms
Waco Aircraft Co.	RBA	466	4,195	O, CBL	2	War	110	1,850	40	450	7.0	.....	8.21	18.05	1,260	350	1,985	105	91	1,710	40	500	12,800	Ms
SINGLE-ENGINED PLANES WITH SEATS FOR MORE THAN THREE PERSONS																								
Stinson Aircraft Corp.	Model R	457	5,595	CLM	4	Ly	215	2,000	55	425	12.4	102	14.15	15.50	2,225	1,100	3,325	130	110	1,800	52	675	14,500	Ms
AUTOGIROS																								
Kellett Aircraft Corp.	K-2	437	7,885	OL	2	Con	165	[1]2,000	35	250	11.0	106	.....	13.30	1,551	255	2,200	.....	.....	.....	.....	.....	.....	.....
Kellett Aircraft Corp.	K-3 Conv'tible	471	8,135	(OC)L	2	K	210	[1]1,900	34	250	13.5	106	.....	10.95	1,670	215	2,300	.....	.....	.....	.....	.....	.....	.....
Pitcairn Aircraft, Inc.	PCA-2	410	15,000	OL	3	Wr Ww	300	2,000	52	.....	.....	108	[1]1.90	10.00	2,093	376	3,000	.....	.....	.....	.....	.....	.....	.....
Pitcairn Aircraft, Inc.	PCA-3	446	15,000	OL	3	Pwj	300	2,000	52	.....	.....	108	[1]1.92	10.20	2,121	415	3,063	.....	.....	.....	.....	.....	.....	.....
Pitcairn Aircraft, Inc.	PAA-1	433	6,750	OL	2	K	125	1,925	27	.....	.....	96	[1]1.63	14.00	1,178	214	1,750	.....	.....	.....	.....	.....	.....	.....

Continued below

Manufacturer and Designation	A.T.C. Numbers	General: Span	General: Length overall	General: Height overall	Areas (sq.ft.): Wing	Areas (sq.ft.): Aileron	Areas (sq.ft.): Fin	Areas (sq.ft.): Rudder	Areas (sq.ft.): Stabilizer	Areas (sq.ft.): Elevators	Wings: Spars: Material	Wings: Spars: How fabricated	Wings: Ribs: Material	Wings: Ribs: How fabricated	Wings: Covering material	Landing Gear: Type	Landing Gear: Tread (in.)	Landing Gear: Wheel type and size	Landing Gear: Brakes	Landing Gear: Shock unit landing gear and tail	Landing Gear: Tail wheel	Fuselage or Hull: Framework: Material	Fuselage or Hull: Framework: How fabricated	Fuselage or Hull: Covering material	Fuselage or Hull: Volume of baggage compartment, (cu.ft.)
PASSENGER PLANES WITH SEATS FOR FEWER THAN FOUR PERSONS																									
Consolidated — Fleet 8	428	28′ 8″	22′ 8″	8′ 2″	174.4	21.7	4.3	12.0	15.2	11.5	Sp	Lmd	D	Rv	Fab	Spl, Al	77	Acp6.5x10	Acp	Ol	Yes	ST	Wl	Fab	.....
Consolidated — Fleet 9	428	28′ 0″	22′ 8″	8′ 2″	172.7	21.7	4.3	12.0	15.2	11.5	Sp	Lmd	D	Rv	Fab	Spl, Al	77	Acp6.5x10	Acp	Ol	Yes	ST	Wl	Fab	.....
Curtiss-Wright-Model 16-E	463	28′10″	21′ 1″	8 10″	206.0	16.3	5.0	7.6	15.4	12.7	Sp	G, Sol	Sp	G, N	Fab	Spl, Al, Ol	76	Apc6.5x10	Acp	Ol, R	Yes	S	Wl	Fab	2.5
Fairchild 22 (C7B)	483	32′10″	22′ 0″	8′ 0″	170.0	29.0	4.1	6.0	15.8	10.4	Sp	I	Sp	Trs	Fab	Spl	91	6.5x10	....	Ol	Op	ST	Wl	Fab	.....
Fairchild 24 (C8)	475	35′ 8″	23′ 2″	7′ 0″	170.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Spl, Al	110	.....	....	Ol, Own	Yes	ST	Wl	Fab	.....
General Western, Meteor	482	32′ 0″	24′ 2″	7′10″	146.8	16.2	4.3	6.5	17.0	13.5	Sp	Box, Ply	Sp, Ply	Trs, G	Fab	Aw, Al	70	Go 20 x9	Go	R, Cd	No	ST	Wl	Alu Fab	1.5
Heath LNB-4, LNA-40	456, 487	31′ 3″	17′ 3″	6′ 2″	135.5	33.6	4.9	5.2	10.0	8.9	W	Sol	Sp	Trs	Fab	Spl	48	Own16x4	Op	Sc, Can	No	ST	Wl	Fab	0.5
Nicholas-Beasley NB-8G	452	37′ 6″	20′ 3″	7′ 9″	163.6	19.1	6.1	6.6	15.9	11.3	W	Sp, Sol	Sp, Ply	Cv	Fab	Spl, Ol	72	Aw	No	Own	No	Me	Wl	Fab	4.0
Rearwin Junior 4000	469	36′ 0″	21′ 8″	7′ 6″	179.5	....	4.4	7.0	14.8	12.2	Sp	.....	.....	.....	Fab	Spl, Al	.....	.....	....	R	No	ST	Wl	Fab	.....
Taylor Cub E-2	455	35′ 3″	22′ 3″	6′ 6″	168.0	16.0	3.0	7.0	18.0	11.0	Sp	Sol	Me	Rv	Fab	Spl	55	.....	No	Sc	No	T	Wl	Fab	.....
United-Stearman	458, 459	32′ 0″	23′11″	9′ 9″	269.5	26.5	4.4	9.9	21.4	12.7	Sp	Sol	Sp	Trs	Fab	Spl	85	Bx 30x 5	Bx	Ol, Cl	Yes	ST	Wl	Fab	8.0
Waco KBA	460	29′ 6″	21′11″	8′ 8″	241.5	.....	.....	.....	.....	.....	Sp	Sol	Sp, Ply	.....	Fab	Own	71	Acp6.5x10	No	Ol, Own	Yes	T	Wl	Fab	.....
Waco RBA	466	29′ 6″	21′ 7″	8′ 8″	241.5	.....	.....	.....	.....	.....	Sp	Sol	Sp, Ply	.....	Fab	Own	71	Acp6.5x10	No	Ol, Own	Yes	T	Wl	Fab	.....
SINGLE-ENGINED PLANES WITH SEATS FOR MORE THAN THREE PERSONS																									

Nicholas-Beazley NB-8G	452	37′ 6″	20′ 3″	7′ 9″	163.6	19.1	6.1	6.6	15.9	11.3	W	Sp, Sol	Sp, Ply	Cv	Fab	Spl, Ol	72	Aw		No	Own	No	Me	Wl	Fab	4.0
Rearwin Junior 4000	469	36′ 0″	21′ 8″	7′ 6″	179.5		4.4	7.0	14.8	12.2	Sp				Fab	Spl, Al				No	R	No	ST	Wl	Fab	
Taylor Cub E-2	455	35′ 3″	22′ 3″	6′ 6″	168.0	16.0	3.0	7.0	18.0	11.0	Sp	Sol	Me	Rv	Fab	Spl	55			No	Sc	No	T	Wl	Fab	
United-Stearman	458, 459	32′ 0″	23′ 11″	9′ 9″	269.5	26.5	4.4	9.9	21.4	12.7	Sp	Sol	Sp	Trs	Fab	Spl	85	Bx 30x 5	Bx	Ol, Cl	Yes	ST	Wl	Fab	8.0
Waco KBA	460	29′ 6″	21′ 11″	8′ 8″	241.5						Sp	Sol	Sp, Ply		Fab	Own	71	Acp6.5x10	No	Ol, Own	Yes	T	Wl	Fab	
Waco RBA	466	29′ 6″	21′ 7″	8′ 8″	241.5						Sp	Sol	Sp, Ply		Fab	Own	71	Acp6.5x10	No	Ol, Own	Yes	T	Wl	Fab	

SINGLE-ENGINED PLANES WITH SEATS FOR MORE THAN THREE PERSONS

Stinson-Model R	457	43′ 3″	26′ 1″	8′ 7″	235	30.6	7.6	13.2	27.0	19.5	Sp	Ro	S	Spt, Wl	Fab	Spl, Al	96	Aut 8.5x10	Aut	Hyd	Yes	ST	Wl	Fab	2.5

AUTOGIROS

Kellett K-2, K-3	437, 471	[2]41′			12′ 4″						W	Box	W		Fab	Own	144	Aut	Aut	Ol	Yes	T	Wl	Fab	5.5
Pitcairn PCA-2, PCA-3	410, 446	[2]45′	23′ 1″	13′ 4″	[6]66.3	24.0	7.8	7.5	15.9	19.2	Sp	Box	Ply	I	Fab	Wb	159	Acp8.5x10	Acp	Ol, Sc	No	ST	Wl	Fab	3.3
Pitcairn PAA-1	433	[3]37′	18′ 7″	11′10″	[5]36.5	15.1	6.7	5.3	9.1	13.0	Sp	Box	Ply	I	Fab	Wb	120	Acp6.5x10	Acp	Ol, Sc	No	ST	Wl	Fab	1.9

A	—Amphibion	Bx	—Bendix	Cv	—Conventional	H	—Hamilton	Lb	—LeBlond	Op	—Optional	Ro	—Routed	St	—Standard	Wh	—Wheel
Acp	—Aircraft Products	C	—Closed	Cy	—Cyclone	He	—Henderson	Li	—Liberty	OX-5	—Curtiss	Rr	—Ranger	Str	—Straight	Wi	—Wire
Ad	—Alclad	Ca	—Cable	D	—Duralumin	His	—Hispano	Lk	—Lockheed	P	—Paragon	Rus	—Rusco	Su	—Supreme	Wl	—Welded
Aer	—Aerol	Can	—Cantilever	Dep	—Deperdussin	Ht	—Heat treated	Lmd	—Laminated	Pe	—Pedal	Rv	—Riveted	Sy	—Story	Wr	—Wright
Al	—Axle	Cd	—Cord	Du	—Dual	Hw	—Hess Warrior	Lr	—LeRhone	Pdd	—Packard Diesel	S	—Steel	Sz	—Szekely	Wt	—Wind Tunnel
Amer	—American	Cg	—Corrugated	En	—Ensign	Hyd	—Hydraulic	Ly	—Lycoming	Pk	—P-K screws	Sa	—Sausedde	T	—Tubing	Ww	—New Whirlwind
Apl	—Applied	Ch	—Challenger	Ex	—Extra	I	—"I" section	M	—Monoplane	Ply	—Plywood	Sc	—Shock Cord	Tr	—Trombone	Z	—Seaplane
Aut	—Autofan	Cir	—Cirrus	F	—Flying boat	In	—Internal	Me	—Metal	Pn	—Pneumatic	Sed	—Screwed	Tred	—Treadle	*	—Without engine
Aw	—Air Wheels	Cl	—Cleveland	Fab	—Fabric	Ir	—Irwin	Men	—Menasco	Pr	—Push Rod	Sd	—Stamped	Trs	—Truss		
Ax	—Axelson	Co	—Comet	G	—Glued	Ja	—Jacobs	Mo	—Monocoque	Pwh	—P & W Hornet	Spt	—Spot	W	—Wood	Autogiro Notes:	
B	—Biplane	Com	—Compression	Ge	—Genet	K	—Kinner	Ms	—Mfr's statement	Pwj	—P & W Wasp Jr.	Sh	—Sheet	Wa	—Walter	[1] 130 rotor r.p.m. at cruising:	
Be	—Beam	Con	—Continental	Go	—Goodyear	Kh	—Kelsey-Hayes	Na	—Navigation	Pww	—P & W Wasp	Sk	—Stick	War	—Warner	[2] Rotor diameter.	
Bo	—Bolted	Cq	—Conqueror	Gr	—Gruas	L	—Landplane	O	—Open	Q	—Sesquiplane	Sol	—Solid	Wat	—Warren Truss	[3] Disc loading.	
Box	—Box spar	Cs	—Coiled Springs	Gt	—Gov't test	La-l	—Ace	Ol	—Oleo	R	—Rubber	Sp	—Spruce	Wb	—Wire braced	[4] Disc area, 1,590 sq.ft.	
Br	—Brownback	Cu	—Curtiss	Gy	—Gipsy	Lam	—Lambert	Old	—Oildraulic	Ret	—Retractable	Spl	—Split	We	—Westinghouse	[5] Disc area, 1,075 sq.ft.	

American engine specifications

Additions to and changes in the table published in AVIATION for January, 1932—AVIATION does not assume responsibility for the figures given

Manufacturer or Agent	Engine	Cooling system	Cylinder arrangement	Number of cylinders	Strokes per cycle	Propeller drive	Rated hp. and r.p.m. at sea level	Maximum hp. and r.p.m. at sea level	Weight dry without hub or starter	Weight per rated hp.	Bore and stroke (in.)	Compression ratio	B.M.E.P.	Displacement (cu.in.)	Frontal area (sq.ft.)	Diameter of mounting ring or distance between bearers (in.)	Height or overall diameter (in.)	Length without starter (in.)	Guaranteed fuel consumption at rated hp. lb. hp.-hr.	Oil consumption lb. hp.-hr.	Valve mechanism	Cylinder construction (see footnote)	Number of intake valves per cylinder	Make spark plug supplied with engine	Number of exhaust valves per cylinder	Type of ignition	Make ignition	Number of carburetors	Make carburetors	Make of starter	Are exhaust manifolds provided	Shipping weight crated	Department of Commerce license number	Price at factory
Guiberson Diesel Engine Co.	Aero Diesel	A	Rad	9	4	D	185–1925		509	2.74	4 1¾/16 x6			982				46 1/16	34 3/16			prr	Al, NS	1	None	1	None		0		Ec	No		79	
Jacobs Aircraft Engine Co.	LA-2	A	Rad	7	4	D	195–2075	205–2200	395	2.03	4¾x4¾	5.5	126	589		14¾	42	37¾	.50	.025	prr	Al, S	1	HT	1	2M	Sc	1	Sg	Hd	Yes	660	82	
Lycoming Manufacturing Co.	R680-BA	A	Rad	9	4	D	240–2000		505	2.10	4 5/16x4½	6.5	140	680		19¼	43¼	32 5/16	.50	.015	prr	Al, S	1	HT	1	Sid	Sc	1	Sg	Ec	No	930	81	
Pratt & Whitney Aircraft Co.	Wasp SD-1	A	Rad	9	4	D	500–2200		750	1.50	5¾x5¾	6.0	134	1344		23 3/16	51 7/16	42 9/16	.60	.035	prr	Al, S	1	BG	1	2M	Sc	1	Sg	Ec	No	1185	76	
Pratt & Whitney Aircraft Co.	Hornet C	A	Rad	9	4	D	600–2000		830	1.38	6 1/16x6 3/8	6.0	140	1690		23 3/16	55 7/16	45 21/32	.60	.035	prr	Al, S	1	BG	1	2M	Sc	1	Sg	Ec	No	1440	83	

A	—Air cooled	Ch	—Champion	Ec	—Eclipse	H	—Hexagonal	Mo	—Monel	prr	—Push rods and rocker arms	So	—Solex
Aa	—Aluminum Alloy	Cm	—Compression	G	—Geared	Hd	—Heywood	M	—Magneto	Rad	—Radial	Sp	—Splitdorf
Al	—Aluminum	D	—Direct	G^1	—5:3 epicyclic gear	HT	—Hurley-Townsend	NI	—Nickel iron	Rad S	—Staggered Radial	S	—Steel
B	—Battery ignition	De	—Delco	G^2	—2:1 reduction gear	Hy	—Holley	Op	—Optional	S.A.E.	—S.A.E. mounting	U	—U.S.L. Electric
RB	—Robert Bosch	Du	—Duplex	G^3	—3:2 reduction gear	I	—Inverted	Opp	—Opposed	Sc	—Scintilla	W	—Water cooled
Be	—Scintilla booster magneto	Dx	—Dixie	G^4	—5:4 reduction gear	L	—Cylinders in line	O	—Own	Sid	—Scintilla—Dual Magneto	Wf	—Winfield
C	—Cast iron	DM	—Dual Magneto	GE	—General Electric	Lh	—"L" head	ohc	—Overhead cam	Sg	—Stromberg	Z	—Zenith

Note: Cylinder construction: first symbol designates head, second—walls or waterjacket, and third—sleeve, if any.

FLYING EQUIPMENT

Fokker fighter for the East Indies

THE Fokker works at Amsterdam, Holland has developed a new single-seater fighter of the D.17 type, fitted with a direct-drive Curtiss Conqueror V-1750 C engine, for the Dutch Army Air Force in the Netherlands East Indies. A special feature which must not be regarded as inherent in the new type is the unusually high landing gear which has been incorporated at the request of the customer due to the nature of their landing fields.

The wings taper both in thickness and chord towards the semi-circular tips. The upper wing is built in one piece secured in the centre section to a cabane consisting of two N-struts bolted to the fuselage. The lower wings are in two halves hinged on to the sides of the fuselage. The upper wing is built up of two box spars with spruce flanges and plywood webs; each half of the lower wing has two solid rectangular spruce spars. Plywood ribs are employed in all panels. A covering of plywood runs from the the top of the front spar, over the leading edge and along the bottom to the rear spar. The remaining portion of the wings is covered with fabric. The upper wing only is fitted with plywood covered wooden ailerons.

The fuselage is a framework of welded seamless steel tubes. The forward portion, back to the pilot's cockpit, is braced with diagonal steel tubes, and the greater part of the remainder with steel wires. The engine mount of welded steel tubes is built integral with the fuselage. The Curtiss Conqueror (compression 1:6) is fitted, but various other types of watercooled engines between 500 and 1,000 hp. may be installed. The D.17 fighter is specially suitable for supercharged engines, such as Rolls Royce Kestrel and the Hispano Suiza Xbrc. The short exhaust stacks do not project beyond the engine cowl which is made of sheet aluminum and easily removed. No special inspection doors are provided.

The undercarriage is of the divided type, fitted with Messier hydraulic shock absorbers. The axles are attached to an inverted V-structure on the bottom of the fuselage.

An oval fuel tank of welded sheet aluminum with a capacity of 50 gal. is installed in the fuselage at the center of gravity. It may be dropped if necessary. A similar oval tank of same capacity may be hinged under the fuselage to give the machine a larger range. For Rolls Royce and Hispano engines a main fuel tank of 58-gal. capacity is used. A 6½-gal. oil tank is installed in front of the main fuel tank above the water radiator. Cooling is effected by means of a Potts oil cooler. The engine water is cooled by a retractable honeycomb radiator, behind the front legs of the landing gear, operated by means of a handwheel in the cockpit.

Two Vickers machine guns, fired by means of an engine-driven synchronizing gear, are mounted ahead of the pilot on a separate frame which may be removed with the guns after the engine cowling has been taken off. The ammunition boxes are also fitted to this frame. Guns are 0.5 in. and 0.3 in. calibre with 200 and 600 cartridges respectively.

The airplane's dimensions and weights follow: Span, 31 ft. 6 in.; length, 23 ft. 7 in.; height, 9 ft. 11 in.; wing area, 215.2 sq.ft.; weight empty (without equipment), 2,358 lb.; useful load, 838 lb.; gross weight, 3,196 lb.; wing loading, 14.8 lb. per sq.ft.; power loading, 5 lb. per sq.ft.

Left: Fokker Conqueror - powered fighter. Below: Two B-J fighters. The Navy observation XOJ-1, at top, and the army YP-16, at bottom.

Two new B-J fighters

TWO experimental military airplanes have recently been delivered by the B-J Aircraft Corporation to the Army and the Navy respectively. The Army machine, which has reached the service test stage and has been designated as the YP-16, is a two-place biplane with a gull-type upper wing. The fuselage is of standard chrome molybdenum tube construction, and the wings

incorporate duralumin spars and ribs,—fabric covered. It is powered with a 600-hp. prestone-cooled Curtiss Conquerer engine. [The YP-16 and its role are further discussed on page 294.]

The naval machine is a two-seater, light observation type, built around the Pratt & Whitney Wasp Junior of 400 hp. The fuselage is of chrome molybdenum tubing, fabric covered, and the wings are of conventional wood spar and rib construction, also fabric covered. It is convertible for sea or land use, and may be equipped with arresting gear for shipboard landings.

At top: The Do.K in flight (description on following page). Above: Single-place Hawk fighter. Left: An Italian convertible plane, as a biplane and as a monoplane.

New Army Hawks

FORTY-SIX single-seat fighters of the Hawk type are now being built by the Curtiss Airplane & Motor Company at Buffalo, for delivery to the First Pursuit Group at Selfridge Field, Mich. The latest type is designated as the P-6-E, basically the same as the original P-6 Hawk, but with added refinement in streamlining and in reduction of weight to yield higher performance. The under-carriage is of the single strut type with both shock absorbers and air wheels, the latter being well enclosed in full streamline housings. The power plant is a prestone-cooled Curtiss Conqueror 650-hp. direct drive engine. The chemical cooling permits the use of a radiator with a very small frontal area whose resistance is further reduced by the addition of the newly designed streamline cowling.

Weight has been saved in the construction of the fuselage by the substitution of chrome-molybdenum for the carbon steel tubing formerly employed. More leg room for the pilot has been obtained by moving the main gasoline tanks slightly, and the addition of a micarta lining to the entire cockpit adds to the pilot's comfort.

The new Hawks have a top speed of 197 m.p.h. and can cruise at 160 miles an hour. Their rate of climb at sea level is 2,100 ft. a minute and they can climb to 16,000 ft. in ten minutes. The absolute ceiling is 26,500 ft.

An Italian convertible mono-biplane

AN airplane convertible at will from a two-seater training biplane to a combat monoplane has recently been delivered to the Italian Air Ministry by the Compania Nazionale Aeronautica at Rome. The upper wings are of the gull type which permits good visibility upward and forward from the cockpits. The outer sections of both upper and lower wings can be detached, and are interchangeable from top to bottom. Both panels are supplied with ailerons. but the control is connected to the upper set only, the lower set being locked in place and useful only as additional wing area. The wings are of wood framework, fabric covered, and all struts are of steel tubing.

The fuselage consists of a wood framework covered with plywood. The undercarriage is of the split axle type, incorporating oleo-pneumatic shock absorbers. A 200-hp. Romeo Lynx power plant is fitted on a quick-detachable mounting.

As a monoplane the machine has a top

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speed approximately 10 km. an hour greater than as a biplane, and lands about 14 km. an hour faster. The useful load is reduced approximately 250 lb.

The Dornier Do.K monoplane

AT THE Loewenthal Flying Field near Friedrichshafen, Germany, test flights are being conducted on a new quadruple-engined commercial land plane—the Dornier Do.K. Such a machine would be suitable for routes offering no possibilities for emergency landings over long distances.

In laying down the lines of the plane, particular attention was given to most favorable aerodynamic construction. The design involves a full cantilevered wing of straight trailing edge and swept-back leading edge of elliptical plan-form (a reversal of conventional practice), an oval streamlined fuselage, and two outboard nacelles each with two air-cooled engines in tandem arrangement. The undercarriage is below the nacelles

The plane is powered by four air-cooled Star engines of 300-hp., although the first model was equipped with 240-hp. Walter-Castor engines. The two forward engines drive four-bladed propellers, and the pusher engines mount two-bladed propellers. The interior of the fuselage from nose to tail is divided as follows: luggage compartment, pilots' cockpit, passenger cabin (seating ten persons), entrance, and lavatory. Dimensions and weights are as follows: Span, 82 ft.; length, 54 ft.; height overall, 13 ft. 9 in.; wing area, 950 sq.ft.; weight empty, approximately 3.5 tons; gross weight, approximately 4 tons.

Jacobs 170 on Waco A

THE latest Waco Model "A," described on page 281 of AVIATION for June, may be fitted with the Jacobs 170-hp. plant in addition to the engines previously listed. Mention of the Jacobs installation was omitted in the original article.

WHAT OUR READERS SAY

Governmental regulation and private airplane construction

TO THE EDITOR:

It seems that AVIATION has definitely taken its stand on the side of those who oppose any activity related to flying unless such activity is under the control of those who are at this time "regulating" the science to extinction. As one of the many who had great hopes for aviation I can not see this happen without objecting.

The demand now being made by various states for federal licenses on all airplanes means plain, simple, outright prohibition — prohibition of private construction and flying. The Department of Commerce knows this. Big Business knows it. Sad as it may be, however, many of those who passed these laws do not know it. Neither do they know that every such law passed means the end of private flying in that state. In the entire history of this country there has never been such a vicious arrangement. The people of this nation provide funds to foster the growth of a young industry. These funds are then used to stifle the industry in the most thorough manner that could be conceived.

It is now unlawful for a man to even try to help a faltering science. If such a man plans and works hard to build himself an airplane and then takes it out on his own pasture land to fly it he becomes a criminal. Can you blame this man if he refuses to uphold such a condition? The Department of Commerce cares nothing about his neck, even if it was in danger. What those in power seem to want is that this man pay far more than he can afford for something he does not want. The normal young American has a creative urge. He wants to build something. To the thousands of young men in this country, flying is a secondary desire. He wants to plan and build something that is different and better. One has but to take the single case of radio to see what such an urge can do for industry. The thousands of "troublesome" radio experimenters of ten years ago are today the engineers and service men who make radio possible. And they had to go through this same "license" trial which, in that case, failed to halt them.

The irony of this situation lies in the fact that the manufacturers who are forcing these laws onto the industry are the ones who are certain to lose. So are the flying schools. This state of Oregon has a small population; but to my certain knowledge there are about 200 young men who are at this time building experimental light planes. Fortunately they are at present allowed to do this under our admirable state law. Well, to fly these ships the men must go to flying schools for instruction. At the nominal outlay of $100 per student think what this means to the schools here. And that is but the beginning. Every one of these men is for the rest of his life bound to be in touch with, and interested in, aviation. Give him a chance to go ahead in his own way now, and he will become the commercial plane buyer of tomorrow.

I want to make a definite statement here. Not more than a handful of these men could, or would at the present time, buy a factory built ship under *any circumstances.* That is final, and that is exactly what is happening to aviation. Watch it work.

If you question those in power you get the stock answers. "Protecting lives —public property—public confidence—" Pure hypocrisy. Any man capable of building or flying a ship has a normal respect for his life. He knows and we all know that he is far safer than he would be with an over powered machine bearing the magic "C" of the Department. Examine the records if you doubt this. Every nice day in the year there is bootleg flying going on and the number of accidents is practically nil. We all know in which class of ships to look for accidents.

I shall not give the figures, but I have been informed as to the number of experimental light plane builders in this country. It is very large. If allowed to exist they are the students of today, the buyers of tomorrow and the very heart of the navy of the air which must fight out next war. Why drive them out? Why not encourage them? Why not place them in touch with men who could help them when in doubt? Either this will be done or there will never be a flying public.

LES LONG,
Cornelius, Ore.

[Mr. Long states his case with exceptional clarity, courtesy and force. We are delighted to give him the opportunity of stating it in AVIATION, and we hope that our readers will think about the matter very carefully for themselves. So far as we are concerned, we are sorry to find ourselves in marked disagreement with him. We appreciate the excellent motives of the young men to whom he refers and the excellent work that they are at times capable of doing. We are sincerely sorry that they should be in any way restricted in their activities. At the same time, it seems to us that flying is a matter so touched with the public interest, and that the whole future of aviation depends to so large an extent upon the development of public confidence in everything connected with flying, that we cannot assent to the suggestion that restriction should be removed. Our hearts impel us to sympathize with the one-man airplane factory, but our heads tell us that it is likely to be a menace, and that it ought to be regarded with suspicion. We should be very much interested in having more correspondence on the subject from other readers of AVIATION, especially if it is as carefully and gracefully phrased as Mr. Long's.—Ed.]

AIRPORT MANAGEMENT

"Pay as you fly" airport plan

A NEW "pay as you fly" plan of charging for field use was inaugurated at the San Francisco Bay Airdrome, Alameda, Cal., on May 1 by R. U. St. John, field manager. It appears to be more equitable than previous flat hangar charges, and at the same time offers a possibility for increased airport revenue. Under the new plan hangar rents are reduced, and a fixed landing charge is assessed against all flying operations. The total charge to all operations, whether permanent or transient, commercial or private, will consist of a floor space charge and a landing charge. Permanent hangar charges range from $10 per month ($110 per year) for planes under 50 hp. or with folding wings, to $100 per month ($1,100 per year) for planes of 85-ft. wing span or greater. Dead storage is charged at 75 per cent of this scale. Transient charges start at $1 per day ($6 per week) for planes under 50 hp. or with folding wings, and range from $1.50 per day ($9 per week) on other planes of less than 30-ft. wing span to $6 per day ($36 per week) for planes over 85-ft. wing span. Field storage is charged at $1 per day.

The landing charges, chief feature of the new plan, are calculated on a sliding scale. For transport operators not renting hangar space, the charge for passengers arriving or departing is 25 cents per passenger for the first 500, 15 cents per passenger for from 500 to 1,000 and 10 cents per passenger for all over 1,000. For all operators renting hangar space, commercial or otherwise, the charge per passenger landing or departing is reduced to 10 cents each for the first 500, 7½ cents each for 500 to 1,000, and 5 cents for all over 1,000. Transient operators renting hangar space pay a flat charge of ten cents for all passengers arriving or departing. Visitors not using hangar space are charged $1 per passenger arriving and departing. Transients and visiting planes are allowed one landing and take-off without charge. Additional flights are charged against them at the rate of 25 cents per passenger arriving and departing. The scale of landing charges on visiting planes applies to all except Army, Navy or Department of Commerce planes. Where no passenger is carried the pilot is counted as one passenger. Where passengers are carried, either for hire or otherwise, the pilot is not counted. A passenger transferring from one plane to another for a through trip is counted but once.

Dog show staged at an airport

A NOVEL method of attracting crowds was employed recently by the Pasadena-Alhambra Airport, Alhambra, Cal., when a week-end dog show was staged at the airport by the Pasadena Kennel Club. An unusually large crowd turned out to see the dogs and to watch a flying program.

Airport service cars

THE Curtiss-Wright base at the Grand Central Air Terminal, Glendale, Cal., maintains a fleet of three automobiles for accommodating visiting planes. The Ford station wagon meets arriving planes, other than the airline transports, and carries occupants and baggage to the airport terminal. A large and a small gasoline and service truck are available for servicing the aircraft. The cars are painted in black and white, a combination which makes them easily distinguishable.

Three service trucks at the Curtiss-Wright base at Glendale, Cal.

Fire house on the field

FULL fire protection is given San Francisco Municipal Airport by the municipal fire department through the operation of a complete, independent fire station on the field. The fire house is located on the line of hangars and is in charge of a fire marshall on duty twelve hours a day. At other times the fire fighting equipment is in charge of the night watchman. The equipment consists of a Ford fire truck equipped with two 40-gal. tanks of Foamite with 300 ft. of attached hose mounted on reels, as well as 300 ft. of 1½-in. water hose for use in connection with the fire hydrants located at strategic points. The truck also carries the usual assortment of ladders and other miscellaneous equipment. The fire house contains a complete first aid station, office, and living quarters for the attendant.

A fence that goes where it is needed

IT IS always a problem to reconcile the conflicting needs of easy accessibility of the hangars of an airport from a good highway, of accessibility of the flying field itself from the hangars, and of guarding the flying area against unwarranted intrusion by pedestrians. Some airports fence across between the hangars, so that no one can pass between them at all, but that is often awkward for mechanical personnel and sometimes it seriously restricts the access of perfectly legitimate sightseers to a point where they cannot watch field operations. At Roosevelt Field, N. Y., the resultant dilemma has been met by mounting a section of substantial woven-wire fence, some 50 ft. long, on rollers runnings on little tracks. Each section of the fence has four flanged rollers about 6 in. in diameter, and the rails on which they operate are some 40 in. apart. The fence can be locked in position when no planes are to be brought in or out, and runs in guides so that it cannot be tipped over or pushed aside. When a plane must pass from the hangars to the field, one man can roll the movable section back to clear the necessary space.

A.I.R.; AN INTERNATIONAL REGISTER OF AIRCRAFT; *Paris; 1932; 950 pages; $20 approximately.* The International Association of Aircraft Classification Societies, of which the American Bureau of Aircraft is the local member, publishes the tenth annual version of its registry. Admirably reliable and admirably complete for every country except the United States. The enormous number of airplanes operating in America and the relatively small part so far taken by American aviation in the work of the classification societies led to the abandonment of any attempt at a complete listing of American planes. Practically every airplane in the world outside the United States is listed in detail.

REPORT OF THE AERONAUTICAL RESEARCH COMMITTEE FOR 1930-31: *H. M. Stationery Office, London; 1931; 89 pages; $0.60 approximately.* As usual, the annual review of the British Aeronautical Research Committee is devoted principally to the studies at the Royal Aircraft establishment and the National Physical Laboratory, with incidental reference to work done under the Committee's direction elsewhere. It covers many problems of design and structural analysis, and should be of marked interest to American engineers.

REPORT ON PROGRESS OF CIVIL AVIATION FOR 1930, *British Directorate of Civil Aviation; H. M. Stationery Office, London; 1931; 101 pages, plus several large maps; $1.60 approximately.* The usual annual report of the progress of civil aviation. Reviews British progress of the year, gives some indication of plans for the future, illustrates the most notable new commercial aircraft and summarizes current operating statistics. Also summarizes, though much less completely, the state of civil flying in other parts of the world.

AIR AND AVIATION LAW, *by Wm. Marshall Freeman; Isaac Pitman & Sons, New York, 1931; 163 pages; $2.25.* A summary of air law as seen from the British Isles, including reprints of all the important British statutes and regulations.

ZEPPELINS OVER ENGLAND, *by Freiherr Treusch von Buttlar Brandenfels; Harcourt, Brace & Company, New York; 1932; 320 pages; $2.50.* A personal narrative of some twenty raids, with discursions on experiences in London before the War, on revolution in Germany after the Armistice, and on troubles with over-optimistic inventors. A book that ought to be read by every officer of the naval air arm and by everyone interested in the commercial use of airships.

BERYLLIUM; *translated by Richard Rimbach & A. J. Michel; Chemical Catalog Company, Inc., New York, 1932; 331 pages; $10.* A collection of some 30 pages on beryllium, translated from the German. Most of them would be of interest only to metallurgists, but four or five deal with the physical properties of the material and its alloys and their possible application in industry.

COURS D'AERONAUTIQUE, *by Emile Allard; Dunod, Paris, 1932; 405 pages; $5.80.* An excellent study of wind tunnels and their use, of aerodynamic theory, and of experimental aerodynamic data. Particularly good on propellers and on the analysis of airplane performance by the use of logarithmic charts.

JAHRBUCH (1931) DER DEUTSCHEN VERSUCHSANSTALT FÜR LUFTFAHRT, E. V.; *edited by Dr. Wilhelm Hoff; Berlin, 1931; 745 pages.* A general review of some 80 studies carried on during the year by the German official laboratory. Includes sections on aerodynamics, structures, materials, engines, navigation, radio, and flight testing. The sections covering the structural and static test work and the free-flight-test section have also been published separately.

APPLIED GYRODYNAMICS, *by Ervin S. Ferry; John Wiley & Sons; New York, 1932; 277 pages; $4.* A good, and not unduly complicated, review of gyroscopic theory and its applications. Some 20 pages are devoted to descriptions of a dozen instruments of particular interest in aeronautics, such as the Sperry artificial horizon and the mechanical pilot.

THE MODERN AIRPORT, *by Sterling R. Wagner; bulletin of the New York State College of Forestry, Syracuse University, Syracuse, N. Y., 109 pages.* A very interesting and up-to-date study of landscape engineering in the location, design and construction of airports, and of their management. Deals with equipment, financial and personnel requirements for all sizes and types of civil fields.

DIE LUFTVERKEHRSWIRTSCHAFT IN EUROPA UND IN DEN VEREINIGTEN STAATEN VON AMERIKA, *by Prof. Carl Pirath; Verlag von P. Oldenbourg; Berlin, 1931; 104 pages.* A report from the Stuttgart Institute for the scientific study of aeronautics. A careful examination into the relations between general business and aeronautical development in the United States, and a comparison between America and Europe.

HIGH-SPEED DIESEL ENGINES, *by Heldt; P. M. Heldt; Philadelphia, 1932; 312 pages; $4.* A discussion of the theory and the detail design of diesel engines of aeronautical and automotive types. Thirty-five pages are devoted exclusively to aircraft diesels, including detailed descriptions of the Packard, Junkers, and six other recent designs, but omitting any mention of the Guiberson work.

STABILITÉ AT MANIABILITÉ DES AVIONS, *by Charles Haus; Gauthier Villars et Cie.; Paris, 1930; 320 pages; $2.50.* A comparatively simple treatment of stability and control, generally adhering to standard methods. Equally good books on the subject are available in English.

ALMANACCO AERONAUTICO 1932, *by Orio Vergani & Giuseppe Mormino; Val. Bompiani & C., Milan, 1932; 334 pages.* A collection of descriptions of the most notable events of the year, with summaries of the present state of aeronautical activities in many countries.

DYNAMICS OF ENGINE & SHAFT, *by R. E. Root; John Wiley & Sons, Inc.; New York, 1932; 181 pages; $3.* A straightforward review of the mathematics of engine vibrations and balancing. Gives special attention to radial and rotary engines.

MÉCANIQUE DES FLUIDES, *by M. Henri Villat; Gauthier-Villars et Cie; Paris, 1930; 175 pages; $2.* A textbook from the French National School of Higher Aeronautical Studies. Useful only for very advanced students of mathematical aerodynamics.

FLUGHAFENANLAGEN, *by Max von Beyer-Desimon; Wilhelm Ernst & Son; Berlin, 1931; 156 pages; $4.* A study of airport layout and airport building design. Probably the best volume of the sort that has appeared on European practice.

LUFTKRIEG 1936, *by Major Helders; Verlag Tradition, Berlin, 1932; 148 pages.* Another detailed account of a hypothetical future war. Better done than most of them.

SERVICING SHORT CUTS

Safety blocking for wheels

WHENEVER the large amphibions or flying boats of Pan American Airways are hauled out of the water at the Dinner Key seaplane base, either on their own wheels or on the specially designed pneumatic-tired beaching gear, a safety blocking device is attached to both wheel axles to prevent the machine from tipping over in case the air pressure in the tires goes down for any reason. This arrangement consists simply of a triangular metal block with a piece of strap iron forming a loop at its apex. The loop is slipped over the projecting wheel axles, and the block is permitted to hang vertically below. It is of such a length that its base clears the ground when the tires are up to full pressure, but it is long enough to rest on the ground and to support the axles if the tire becomes deflated.

Checking instruments

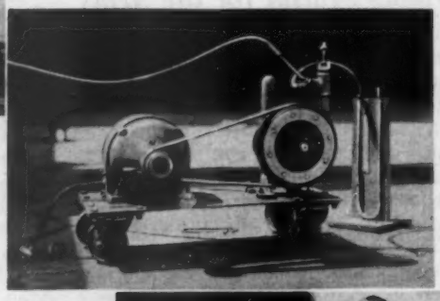
TO facilitate the testing and calibration of gyroscopic instruments on board their airplanes, the Atlanta shops of Eastern Air Transport are making use of a portable electrically driven vacuum pump. Both pump and motor are bolted to a common base plate, which is mounted on swiveling casters for convenience in pushing about the hangar floor and the apron. With the airplanes whose instruments are to be checked blocked up in flying position, the vacuum unit is rolled into some convenient location nearby and connections are made between pump and the venturi system by means of flexible rubber hose. A mercury-filled manometer attached to the line indicates the degree of vacuum in the system. In this way bank and turn indicators, directional giros, and Sperry horizon may be checked under operating conditions with the airplane at rest on the ground.

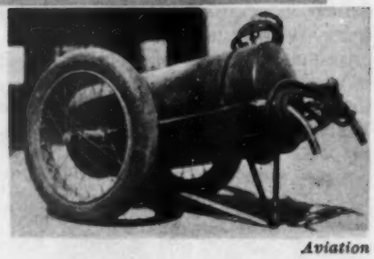
Cylinder head heater

FOR expanding cylinder heads to remove and replace valve guides and valve seats, the Thompson Aeronautical Corporation has developed a gas heater adjustable to the various types of engine cylinders. The device consists of a pipe framework which supports near its base a pair of ordinary cooking range gas burners, arranged side by side and close together. A clamping device holds the cylinders by the flange, head down over the two burners. Heat is applied directly to the head and is evenly distributed to prevent warping or undue strain. A thermo-couple indicator permits close control of the heating.

Portable air tank

A SIMPLE piece of apparatus which has proved to be highly useful around the field or hangars of the American Airways shops at Dallas, Tex., is a small compressed air tank mounted on a pair of pneumatic-tired wheels and equipped with suitable handles and supporting stands. No compressor is attached to this unit, as is commonly the case with the standard portable compressed air machine used in garage work. It is simply a storage tank which is filled periodically by attachment to one of the shop compressed air lines. Its principal use is to supply air for tires on the field, or to operate a small paint spray outfit in remote locations.





Pan American's blocking device to support the axles of landing gear in case the tires become deflated. Right: The E.A.T. Atlanta shop's portable vacuum pump. Lower right: Portable compressed air at American Airway's in Dallas.

Aviation

Modern mercury

MANY industrial plants, especially those connected with the aircraft industry, are becoming so spread out that the time required for mail clerks or messengers to go from place to place entails an appreciable loss. Some plants have provided bicycles for messenger boys, but Eddy Jones, who runs errands and ferries messages around the huge Transcontinental and Western Air hangar at Kansas City, has been equipped with a pair of roller skates. The broad expanse of hangar floor and apron give Eddy ample opportunity to exhibit his agility, and the average time for running his errands has been appreciably reduced.

Good housekeeping

MORE and more airline repair shops are profiting by a lesson which has taken industry as a whole a good many years to learn—that good housekeeping pays dividends. A clean and orderly shop has a definite psychological reaction, not only on visitors but on employees, and a small amount of money spent in keeping up appearances often yields positive returns in improved quality of work. Certain cleaning compounds applied hot under high pressure, have been found very effective in removing grease and oil from floors, machinery, engine parts, etc. Several ways of making such applications are available, but a number of airline shops including the Pan American Airways base at Brownsville, Tex., the Transcontinental & Western Air shops at Kansas City, and United Air Lines at Chicago, are making use of a device known as the "Hypressure Jenny," manufactured by the Homestead Valve Manufacturing Company. This unit is entirely self-contained and is mounted on a small truck for portability.

THE BUYERS' LOG BOOK

Aircraft chair

Metallurgical Laboratories, Inc., of 1116 West Montgomery Ave., Philadelphia, Pa., exhibited at the Detroit Aircraft Show the prototype of a series of new chairs for transport airplanes. Several basic designs have been produced whose over-all dimensions, finish and upholstery may be modified to suit specific requirements. Welded steel tube of high tensile strength is used throughout for framing, and the assembly is heat treated after welding. The chair is adjustable to a variety of reclining positions, and provision is made for the attachment of safety belts. Depending upon customers' requirements, the frame of the transport chair weighs from 7 to 9 lb., the upholstery 5 to 10 lb., making the total weight of DeLuxe models range from 12 to 19 lb. complete.—AVIATION, *July, 1932.*

Portable beacon for the Army

The Westinghouse Electric and Manufacturing Company of East Pittsburgh, Pa., has recently supplied the United States Army with a portable radio beacon transmitter. This apparatus will operate in conjunction with a main fixed beacon, the latter being used for the location of the airport and the small transmitter for a designated landing on a particular runway. All the equipment, including a gas engine-driven generator, is mounted on one truck, is fully portable, and weighs approximately 1,800 lb. The transmitter is rated at 100-watt per loop over a frequency range of 225-375 kilocycles. Tests have indicated that a range of 15-25 miles may be expected under good conditions.—AVIATION, *July, 1932.*

Semi-air wheels for transports

The Firestone Tire & Rubber Company of Akron, Ohio, has recently produced a low-pressure tire designed for use on transports of the Ford class. With the new Firestone 15.00-16 Air Balloons, the gross load rating for a Ford transport has been increased to 14,000 lb. Decreased maintenance costs and increased comfort and safety for passengers are claimed for the new equipment.—AVIATION, *July, 1932.*

Safety belt harness

A combination safety belt and parachute harness has been developed by the Irvin Chute Company, Inc., of 372 Pearl St., Buffalo, N. Y. The entire equipment, including the parachute and its harness remains in the airplane at all times. The pilot simply climbs into the seat and snaps one set of harness which not only constitutes the parachute attachment but also holds him firmly and comfortably in his seat without a separate safety belt adjustment. An emergency release strap is available, which instantly disconnects the safety belt harness and permits the pilot to leave the airplane with his parachute still attached to him. The harness may also be used without a parachute as safety belt equipment only.—AVIATION, *July, 1932.*

Portable light

A rather ingenious portable lighting unit for shop, hangar, or garage use is being marketed by the Benjamin Electric Manufacturing Company of Des Plaines, Ill. The "Mobilite" device consists of a porcelain enameled steel floodlight reflector with a cover glass protected by a wire guard, mounted on a small three-wheeled truck. The truck has swiveling rubber tired casters and is provided with a handle. The entire unit is low enough to be used under automobiles, in servicing pits, or in any other location where head-room is limited. It is made in 100-watt and 200-watt lamp capacities. Each unit is equipped with 25 ft. of rubber covered extension cord. The larger unit is 12½ in. in maximum height, 18 in. long, and weighs 27 lb. complete.—AVIATION, *July, 1932.*

Szekely engine parts

Replacement parts for Szekely engines are now available through Air Transport, Inc., of Roosevelt Field, Long Island. The most recent type of reinforced cylinders and crankcases may be obtained from this source.—AVIATION, *July, 1932.*

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Catalogs

Pratt & Whitney Aircraft Company (twelve pages). Photographs and descriptions of famous flights, using Pratt & Whitney engines.

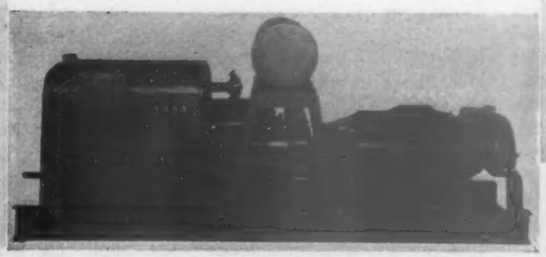
Associated Alloy Steel Company, Inc., Cleveland, Ohio. Description and properties of "Nevastain" alloy steel.

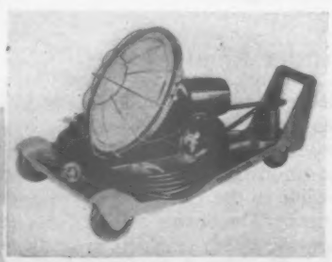
The B. F. Goodrich Company, Akron, Ohio. "A Wonder Book of Rubber." A story of rubber from tree to finished product.

Berry Brothers, Detroit, Mich. "Wax free paint and dope remover." A three-page bulletin describing uses and directions for use.

Eisler Electric Company, Newark, N. J. A 24-page bulletin describing "Speed" spot welders.

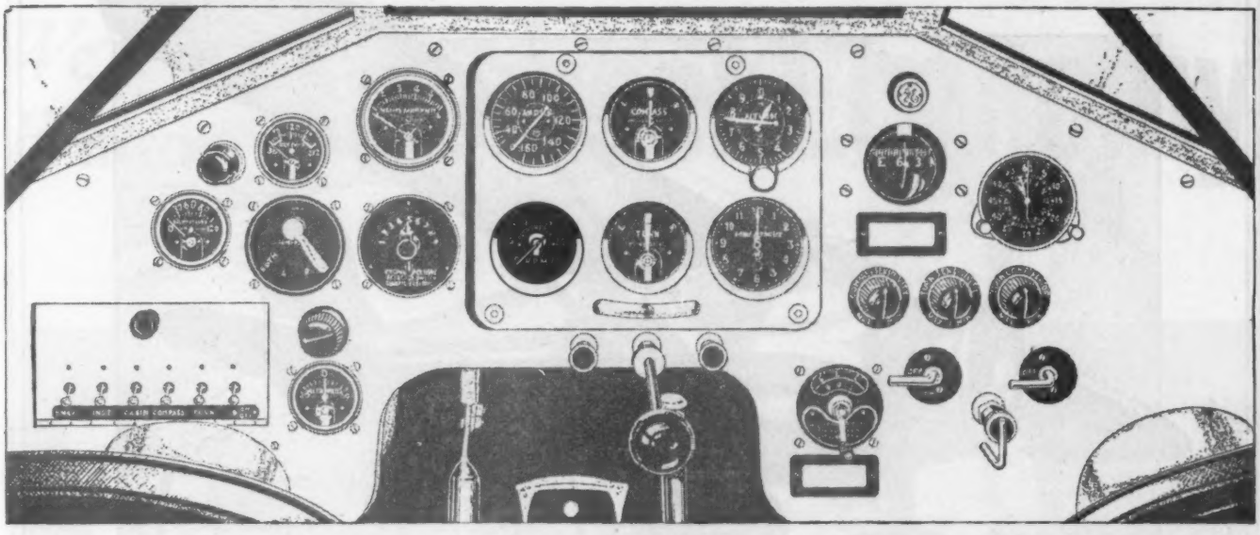
Nicholas-Beazley Airplane Company, Inc., Marshall, Mo. "Aeronautical Parts and Supplies." A 96-page catalog covering practically all materials and supplies for aircraft and engines.





Left: Metlab De Luxe transport chair. Center: Western Electric portable beacon. Above: Benjamin Electric portable light.

LOOK TO ELECTRIC INSTRUMENTS for PERFORMANCE at LOW COST



The GENERAL ELECTRIC TACHOMETER

All General Electric instruments are available in shock-absorbing cases of standard dimensions for flush mounting. Jeweled bearings and luminous pointers and scales are used

Electric instruments are characterized by simplicity. For example, the only connection between the engine and the General Electric tachometer is a small-sized electric wire. This takes the place of the conventional tachometer drive shaft, and simplifies installation and reduces maintenance costs. Furthermore, it results in a substantial reduction of weight where long-distance installations are involved—between outboard engines and the instrument panel.

The General Electric tachometer depends on the frequency of alternating current produced by a small generator, which is easily attached to the standard tachometer fitting on aircraft engines. This generator has no commutator and no brushes; it produces alternating current that is always in synchronism with the speed of the engine. The indicating instrument measures the frequency in terms of rpm., so that fluctuations in voltage do not affect the accuracy of the instrument. Let us send you complete information. Address General Electric Company, Schenectady, N. Y.

Aëronautic Equipment Specialists in New York, Washington, Dayton, and Los Angeles

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GENERAL ELECTRIC

Use **MARFAK** for more effective rocker-arm lubrication

Texaco Marfak Grease has solved the problem. It is used for this critical lubricating job at an ever increasing number of the country's airports, flying service bases and aviation schools.

It is an unusual lubricant. Texaco Marfak Grease is highly recommended for rocker-arm lubrication and enclosed grease-packed bearings because of its remarkable heat resistance and ability to cling to bearing surfaces, stay soft and preserve its lubricating qualities intact. It lasts longer than other grease lubricants.

Just make the test. Try Texaco Marfak Grease of the proper grade. You will find it the most dependable heavy lubricant you have ever used.

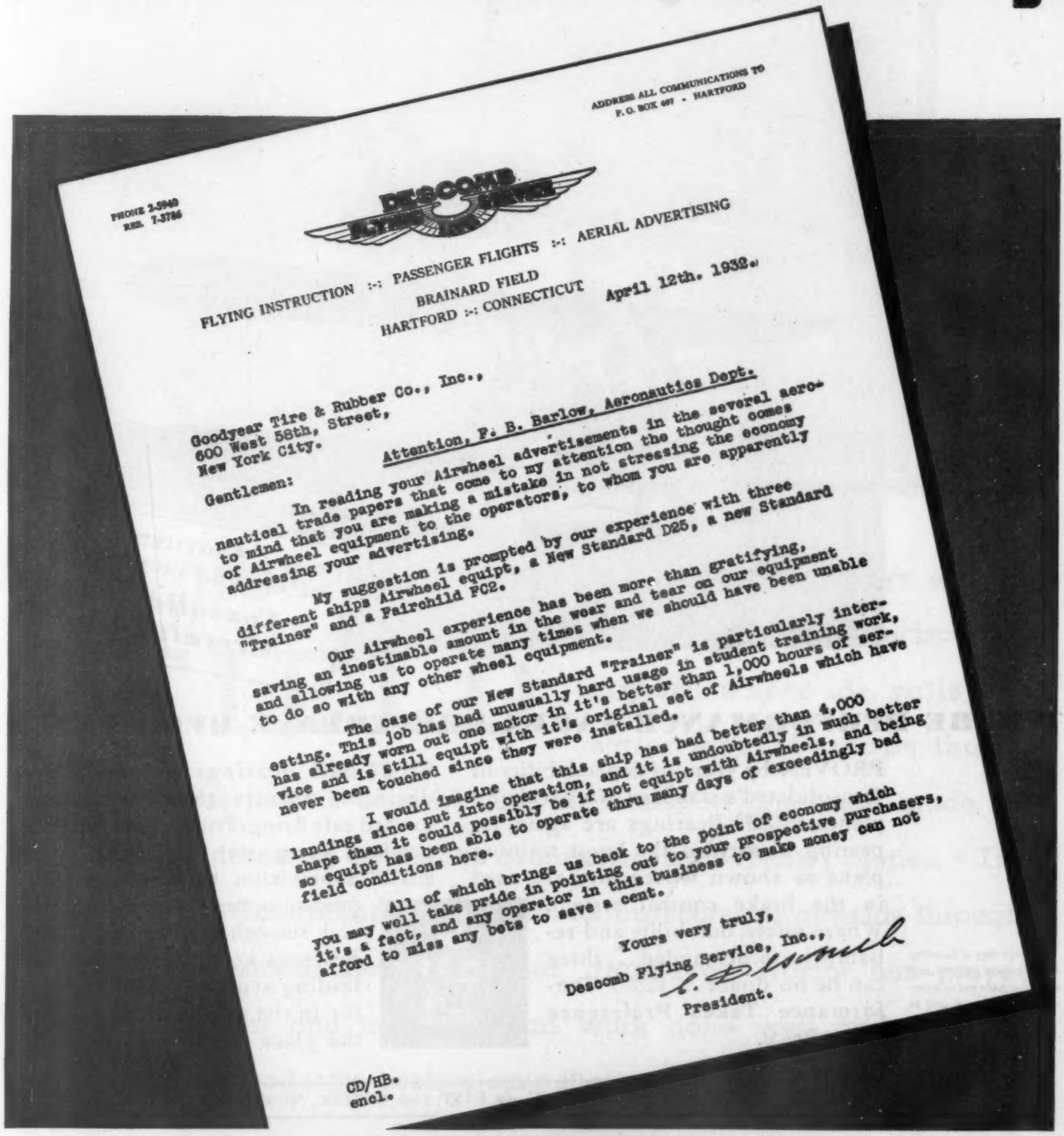
Texaco Marfak Greases, Texaco Airplane Oils and Texaco Aviation Gasoline are available at principal airports throughout the United States.

THE TEXAS COMPANY, 135 East 42nd Street, New York City

TEXACO AVIATION GASOLINE
TEXACO AERODIESEL FUEL
TEXACO AIRPLANE OILS
TEXACO MARFAK GREASES
TEXACO ASPHALT PRODUCTS
[For Runways, Hangar Floors and Aprons and Dust Laying]

THANKS, MR. DESCOMB

We'll Feature Airwheel Economy



PHONE 2-5940
RES. 7-3786

DESCOMB FLYING SERVICE

ADDRESS ALL COMMUNICATIONS TO
P. O. BOX 697 - HARTFORD

FLYING INSTRUCTION :-: PASSENGER FLIGHTS :-: AERIAL ADVERTISING

BRAINARD FIELD
HARTFORD :-: CONNECTICUT

April 12th. 1932.

Goodyear Tire & Rubber Co., Inc.,
600 West 58th, Street,
New York City.

Attention, F. B. Barlow, Aeronautics Dept.

Gentlemen:

In reading your Airwheel advertisements in the several aeronautical trade papers that come to my attention the thought comes to mind that you are making a mistake in not stressing the economy of Airwheel equipment to the operators, to whom you are apparently addressing your advertising.

My suggestion is prompted by our experience with three different ships Airwheel equipt, a New Standard D25, a new Standard "Trainer" and a Fairchild FC2.

Our Airwheel experience has been more than gratifying, saving an inestimable amount in the wear and tear on our equipment and allowing us to operate many times when we should have been unable to do so with any other wheel equipment.

The case of our New Standard "Trainer" is particularly interesting. This job has had unusually hard usage in student training work, has already worn out one motor in it's better than 1,000 hours of service and is still equipt with it's original set of Airwheels which have never been touched since they were installed.

I would imagine that this ship has had better than 4,000 landings since put into operation, and it is undoubtedly in much better shape than it could possibly be if not equipt with Airwheels, and being so equipt has been able to operate thru many days of exceedingly bad field conditions here.

All of which brings us back to the point of economy which you may well take pride in pointing out to your prospective purchasers, it's a fact, and any operator in this business to make money can not afford to miss any bets to save a cent.

Yours very truly,
Descomb Flying Service, Inc.,
L. Descomb
President.

CD/HB.
encl.

THE GREATEST NAME IN RUBBER

GOODYEAR

IF IT ISN'T A GOODYEAR IT ISN'T AN AIRWHEEL

SAFETY WITH SKF BEARINGS REMAINS UNQUESTIONED

ANOTHER "PERFORMANCE" USER
Consolidated Aircraft Corp.

WHERE PERFORMANCE TAKES PREFERENCE OVER PRICE

PROVEN by years of dependability in Consolidated's standard Navy training planes, SKF Bearings are again repeating history on the latest training plane as shown where they are used in the brake control system. Where safety, durability and reliability are demanded... there can be no doubt... SKF Performance Takes Preference Over Price.

SKF Ball Bearings possess every desirable feature that contributes toward safe flying. From ore to finished product, every step is under strict SKF supervision to insure quality, precision, ruggedness, long life and smooth operation. SKF Bearings are the first choice of leading aviation manufacturers, for in the air... nothing takes the place of PERFORMANCE.

You may buy a bearing as a bargain but try and get a bargain out of using it, for nothing is apt to cost so much as a bearing that cost so little.

2875

SKF INDUSTRIES, INC. 40 EAST 34th STREET, NEW YORK, N. Y.

SKF

Ball and Roller Bearings

A HOSPITABLE FIELD

Safe, smooth runways are the pride of this San Francisco Bay airport, where air, rails and water meet. Perhaps that is why the field is used by five air transport lines and made the headquarters of numerous commercial and visiting planes. • This port is "Caterpillar"-kept. Here, as on scores of airfields throughout the world, the "Caterpillar" track-type Tractor has proved that power and traction mean work done well and speedily. And the moderate costs please those responsible for the budgets.

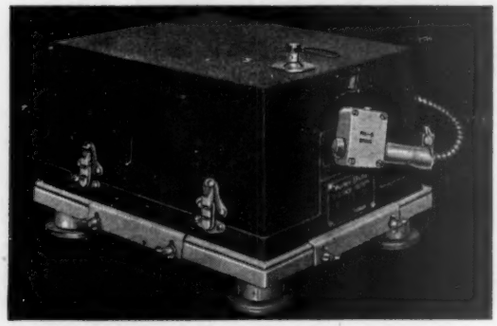
Caterpillar Tractor Co., Peoria, Ill., U.S.A.
Track-type Tractors Combines Road Machinery
(There's a "Caterpillar" Dealer Near You)

Prices—f. o. b. Peoria, Illinois

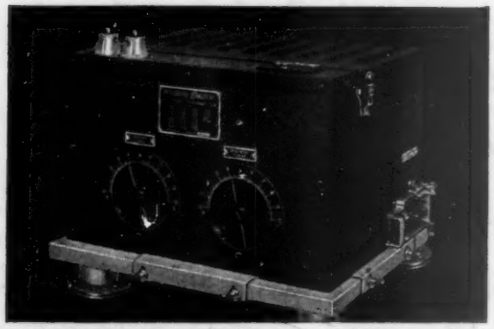
FIFTEEN	$1100	THIRTY-FIVE	$2400
TWENTY	$1450	FIFTY	$3675
TWENTY-FIVE	$1900	SIXTY-FIVE	$4350
DIESEL	$6500		

CATERPILLAR
REG. U. S. PAT. OFF.
TRACTOR

. . . 2-way Radio Telephone for YOU!



No. 9D receiver — standard for receiving Department of Commerce weather broadcasts and radio range signals.



No. 11A aircraft transmitter — little brother of the apparatus used on all the leading airlines.

Light, compact, dependable

Now *you* can fly as the transport pilot flies — with Western Electric two-way radio telephone to aid you. Radio beacon signals, weather reports, landing instructions enable you to fly with new confidence.

Western Electric — whose aviation equipment is standard on all the major airlines of the country — makes receiving and transmitting apparatus specially designed for private planes . . . and transmitters for airport use in communicating with them. You can install your receiving outfit first (weight 30 lbs.) and add transmitting apparatus later to give you the two-way radio telephone system (weight about 65 lbs. complete). All equipment is compact, easily installed, accessible and thoroughly flight-tested.

For full information, address Western Electric Company, Dept. 272 AD, 195 Broadway, New York.

Airport operators!

More and more private flyers are using Western Electric — it will pay you to give them full co-operation via radio telephone. Install the Western Electric No. 10A transmitter!

Western Electric*

Aviation Communication Systems

MADE BY THE MAKERS OF BELL TELEPHONES

**Northern Electric in Canada*

RECOGNITION

1930 • COLLIER TROPHY AWARD . . "for the greatest achievement in aviation in America, the value of which has been demonstrated by actual use during the year."

1931 • JOHN SCOTT MEDAL . . "for the invention of the Autogiro, its improvement and development . . . and its introduction into America."

1932 • DANIEL GUGGENHEIM MEDAL . . "for aeronautic achievement in developing the theory and practice of the Autogiro."

AUTOGIRO

AUTOGIRO COMPANY OF AMERICA • • • LAND TITLE BUILDING • • • PHILADELPHIA

And let an Exide Aircraft Battery give you safe, dependable current for lights and radio

BEAUTIFUL take-off . . . not a worry in the world! An Exide Aircraft Battery is on the job.

This famous battery makes radio communications certain . . . supplies reliable current for landing and position (navigation) lights. Exide Aircraft Batteries are made to fly. Many of your friends wouldn't fly without them. Here's the answer: dependable, compact, light, non-spillable, and long-lived.

Write today for more information about the many types of Exide Aircraft Batteries.

TAKE TO THE AIR—WITH SAFETY

Do you know that airway travel today is more than 4 times as safe as it was 3 years ago? During the January to June period of 6 months in 1931 there was but one fatality in each 5,277,989 passenger miles flown.

Dependable Exide Aircraft Batteries, standard equipment on most transport and mail ships, contribute to safety.

ACCA

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Contractors to the U. S. Army and Navy

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

MORE POWER TO IT—

Waco powered by Jacobs—more power to it—an ideal combination. • A ship is no better than its power plant. Too little power is a handicap while surplus power is an extravagance. • A Waco A or F2 powered by Jacobs "170" gives private flying the maximum of performance with the lowest flying cost and the minimum maintenance expense.

JACOBS
AIRCRAFT ENGINES

JACOBS AIRCRAFT ENGINE CO.

Main Office and Plant
Pottstown, Pennsylvania

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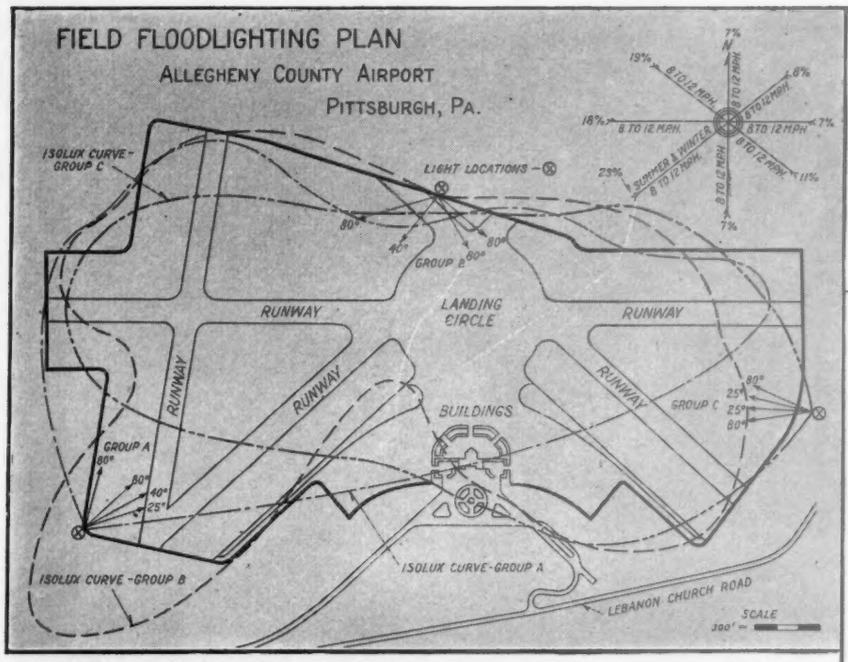
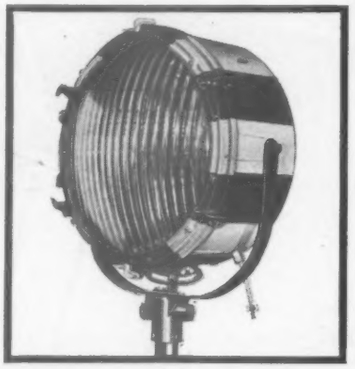
Central Airport, Camden, N. J.



Allegheny County Airport, Pittsburgh, Pa., lighted by Westinghouse, is fast gaining the reputation of being one of the world's finest airports.

Westinghouse Landing Field Floodlight.



TRANSPORT LINES CHOOSE *well-lighted* airports . . .

WHEN mapping out operation schedules, air transport companies obviously must consider the possibility of night landings. As a result, their selection of airports is narrowed down to those on which they can make as safe landings after dark as by daylight.

It's the well-lighted airport that gets the business. Facilities for 24-hour operation is one of the strongest bids an airport can offer to obtain business from transport lines.

To fill every requirement necessary for night landings, and to win for your airport the highest reputation among pilots, install a planned system of Westinghouse lighting—a system planned by Airport Lighting Specialists which you can progressively and economically expand for future growth.

THE COMPLETE LINE OF WESTINGHOUSE AIRPORT LIGHTING EQUIPMENT INCLUDES—

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1. Alidade, or Ceiling Height Indicator
2. Airways Course Light
3. Landing Field Floodlight on Hollowspun Standard
4. Department of Commerce Type Rotating Beacon
5. Auxiliary Airport Beacon (Code Beacon)
6. Screw Type Marker Light
7. Illuminated Wind Tee
8. Wind Cone Assembly
9. Ceiling Projector
10. Obstacle Light
11. 200 M/M Fresnel Hangar Floodlight
12. Locking Type Marker Light
13. Flush Type Marker Light
14. Tip-over Cone with Marker Light and Disconnect

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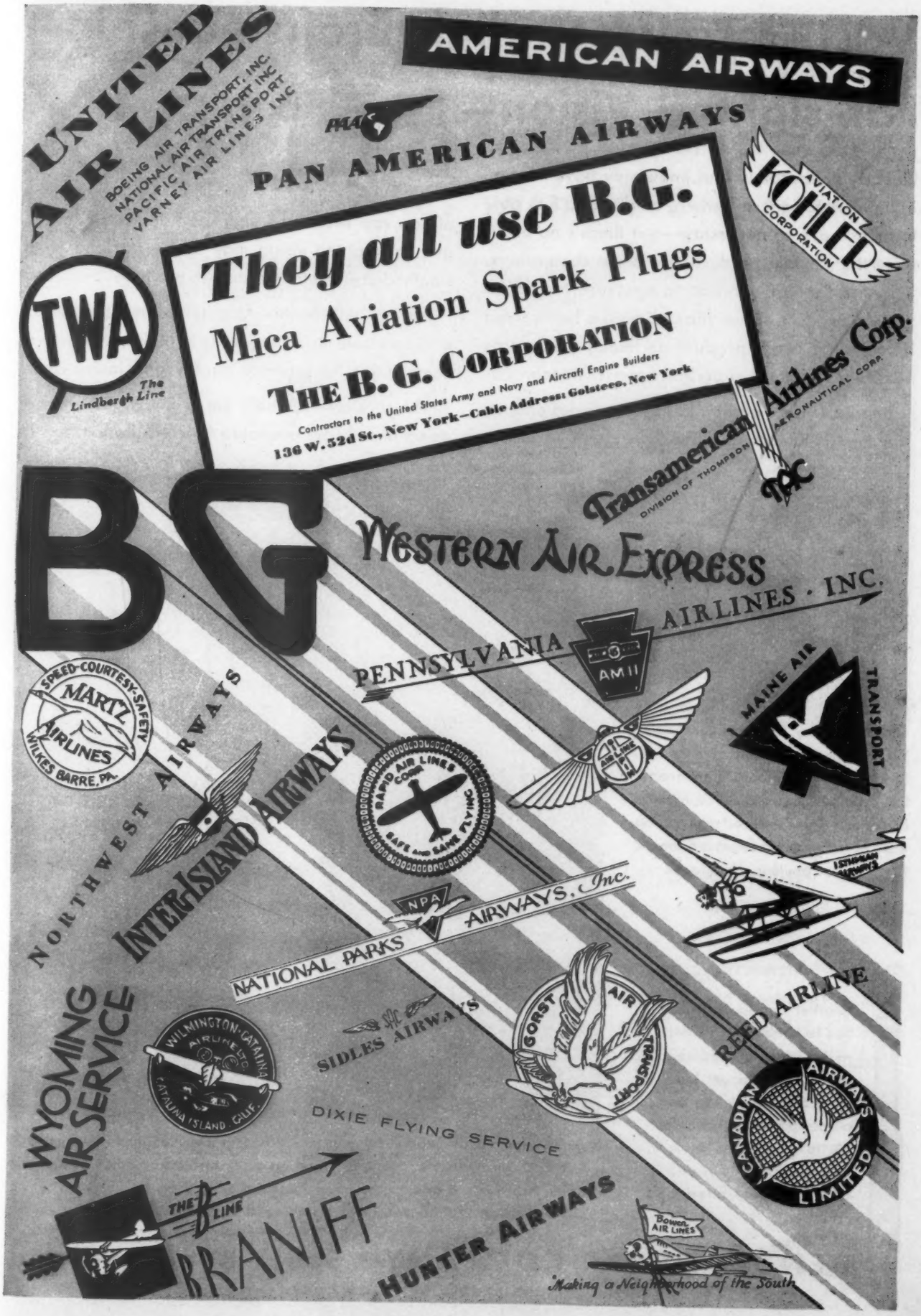
Westinghouse

Westinghouse Lighting Specialists will help you plan an effective lighting system


UNITED AIR LINES
BOEING AIR TRANSPORT, INC.
NATIONAL AIR TRANSPORT INC.
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They all use B.G.
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HUNTER AIRWAYS
BOWEN AIR LINES
Making a Neighborhood of the South

Vast Resources—High Craftsmanship—Far-sighted Vision—BENDIX

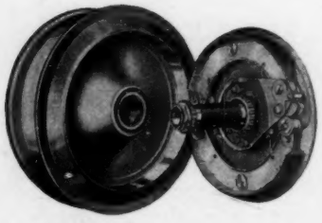
Nobody deliberately and knowingly buys inferior equipment for aircraft, where quality and fine performance are so necessary—yet there's no argument that certain products are *better* than others.

In the face of unrelenting pressure to reduce quality, Bendix believes that Aviation is best served by building every product as nearly perfect as possible; aiming at superlative performance.

Bendix Wheels and Brakes for airplanes and the new Bendix Pneudraulic Shock Strut are examples of how vast resources, high spirit of craftsmanship, and far-sighted vision may all be inspired by a single idea—a determination to produce "the best."

And typically Bendix is the development of special and exclusive machinery used in their manufacture; contributing to superior quality and lower costs.

The services of Bendix' corps of competent engineers are always available for consultation.



The pioneer product of their kind, and standing today as always for preeminence in quality, Bendix roller bearing Wheels are the standard type for military and civilian planes. Permanently improved braking, exact concentricity of brake and drum, reduced take-off run, ease of taxi-ing and improved ground handling are obvious advantages.

A good example of Bendix' constant study to improve manufacturing methods is this 250 ton hydraulic press, for forming discs and many other parts. This machine has made it possible to form aluminum alloy parts in a manner which had never been accomplished before.

Another Bendix contribution to comfort and safety—the Bendix Pneudraulic Shock Strut. Impact loads absorbed by oil flow and air compression above the oil; taxi-ing loads by air compression. Rebounds definitely controlled by snubber.

BENDIX BRAKE COMPANY • South Bend, Indiana

(SUBSIDIARY OF BENDIX AVIATION CORPORATION)

"ANDES BELOW!"

Ford Planes on Pan American-Grace Lines Fly 832,000 miles without a casualty

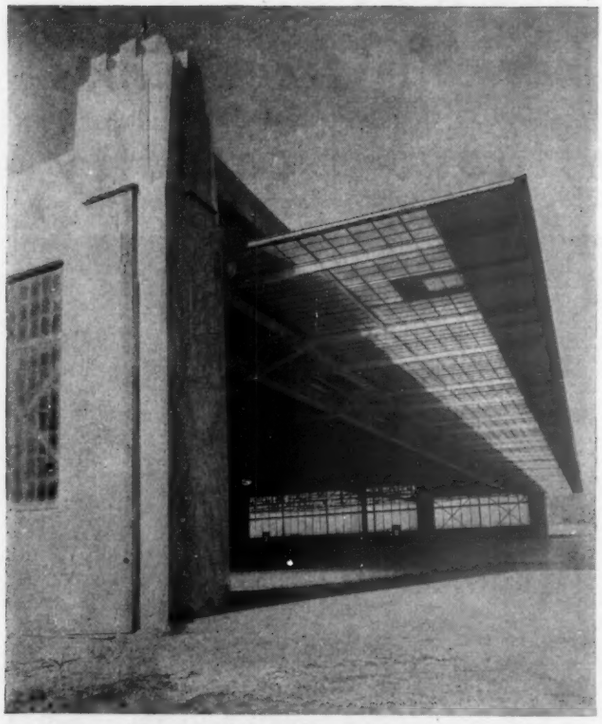
Mt. Aconcagua, Argentina, highest Andean peak (22,860 feet), viewed from Panagra Ford plane at 19,000 feet. At left — coming into Santiago, Chile.

PAN AMERICAN-GRACE AIRWAYS, INC., flies five Ford tri-motored all-metal planes between Talara, Peru, and Montevideo, Uruguay. This schedule calls for 12,000 miles each week or the equivalent of around the world in two weeks. The Fords operate over the Andes at an altitude of between 16,000 to 20,000 feet. Frequently a full load is carried—12 passengers, pilot, radio operator and steward. Recently, during the suspension of the Transandine Railroad from Santiago, Chile, to Mendoza, Argentina, Ford planes provided the only direct transportation between these two large countries. 832,000 miles had been covered, without injury to passengers or crews.

Time-table reliability, the safety of three motors, and the permanence of Ford all-metal construction are essential to successful and profitable airline operation anywhere. Continuous service, low cost maintenance and unusually long life have convinced many operators that Ford planes are the most economical they can buy. Write for details of the many improvements and refinements made during the past year.

FORD MOTOR COMPANY

·TRUSCON The Most Complete Line·



Airplane Hangar with 300-foot clear door opening. Note pass door at each end of Kanopy door.

HANGAR DOORS

Original Kanopy Type

These steel hangar doors actually increase the size of the building by swinging up and out to form a protecting canopy as large as the door area. The entire side of the building or any section of it can be opened fully or part way.

Original Kanopy Type Hangar Doors are operated mechanically by merely pressing a button. When open, these doors are completely out of the way and do not occupy useful floor space. Tracks and other obstructions are also eliminated. Kanopy Doors are furnished in any size and with any amount of glass for daylighting.

Full information on request.

MANUFACTURED BY

TRUSCON STEEL COMPANY

YOUNGSTOWN, OHIO

Engineering and Sales Offices in all Principal Cities

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15 to 20 HOURS MORE SERVICE from KENDALL THE 30 HOUR OIL

SIDLES AIRWAYS CORPORATION
UNION AIRPORT
LINCOLN, NEBR.

May 9, 1932.

Kendall Refining Co.,
Bradford,
Pa.

Attention: Robert E. Dake,
Aviation Division.

Gentlemen:

For the past year we have been using Kendall Oil in our different aircraft engines, which number approximately eleven types and makes, and find that it gives us perfect lubrication through the cold winters and the extreme heat of the summers which we experience in Nebraska.

As you know, we operate some of the finest training ships in the Middlewest in our school of aviation and their constant use allows us to give Kendall Oil a pretty severe test under the different temperatures and conditions which school ships are subject to.

Kendall has reduced our oil costs materially due to its longevity, giving us as high as 40 hours of service which is from 15 to 20 hours more than we were able to expect from other aircraft oils. It has also made our engine overhauls less numerous because of the small wear which shows up in the working parts.

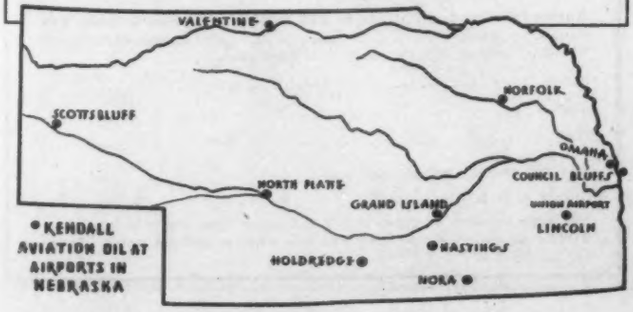
We believe the KENDALL REFINING COMPANY deserves a great deal of credit for producing an oil which has been so generally accepted by the Aviation Industry in this country.

Yours very truly,

SIDLES AIRWAYS CORPORATION.

HBS-RHB

Harry B. Sidles, President.



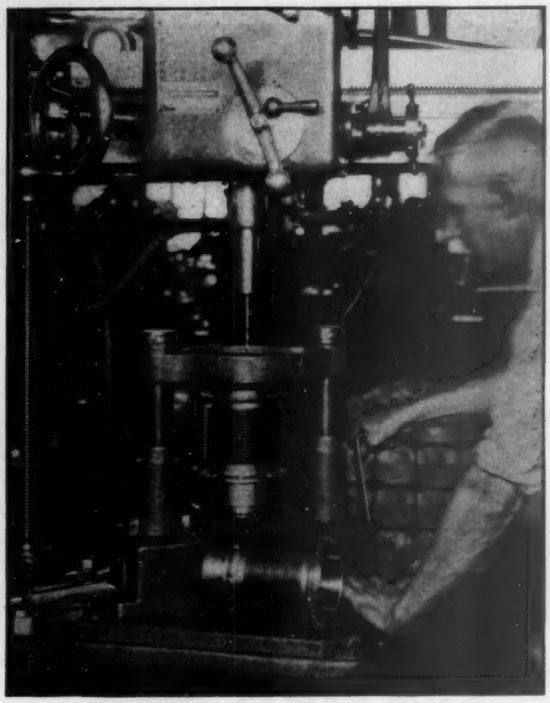
THIS recent letter from Sidles Airways Corp. of Lincoln, Nebraska, is just further evidence that Kendall quality shows its superiority in several important ways. Lower oil costs due to its longevity . . . fewer engine overhauls because of Kendall's protection against wear in working parts... perfect lubrication throughout Nebraska's cold winters and extremely hot summers . . . and almost double the number of flying hours on a filling of oil.

These results mean important savings in operating costs. They mean that Kendall is not only the quality *ace* in aviation oils—but extremely economical to use. And every aviator can easily prove Kendall's quality for himself, because it is available at important airports throughout the country... It is by all odds the leading aviation oil.

KENDALL REFINING COMPANY · BRADFORD, PA.

KENDALL
THE 30 HOUR OIL

MERELY MAINTAIN THE PROPER OIL LEVEL



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GOVRO-NELSON *for*

DESIGN, ENGINEERING *and*
PRECISION MANUFACTURE

At the shops of Govro-Nelson you will find Engineering Experience that has majored in the design and production of airplane engines.

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You will find precision for a watchword. Correct design, accurate tooling and precision production are requisites for all aircraft work.

These three things are available to you either individually or collectively on either a small order or a large order at Govro-Nelson. We shall be glad to make recommendations or quotations if you will send us blue prints.

THE
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COMPANY
1931 ANTOINETTE DETROIT

CRAFTSMEN TO THE
AVIATION INDUSTRY

EASY
to Own this Plane!

ANYONE who wants the thrill of a plane of his own can now satisfy that desire. Heath pioneered low cost construction and operation in aviation. Now, Heath makes the most attractive offer in all their twenty-three years' experience: A NEW LOW PRICE — A new simplified assembly kit — Deferred payment plan.

Costs are down to bed rock. Construction is easier. Parts can be shipped in groups. You pay only as ordered. Fuselage, tail, rudder, elevators and stabiliser completely welded. Ribs built complete at the factory. All you have to do to have a trim, fast ship of your own is assemble the ready-built units.

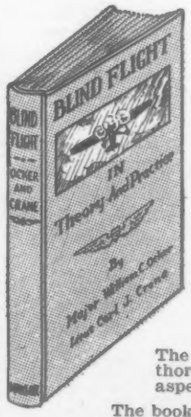
When assembled with our simple instructions, Heaths are eligible for Dept. of Com. License. Have won National Air Races last six years. Heath holds world's altitude record for light planes, 17,907 feet.

FLY THIS SUMMER

We are making it easier than ever before to own a plane. You can be flying in three or four weeks. The first parts come for only $16.00. Complete plane (less motor) ready to assemble $399. Only large scale methods make this low price possible. Factory built ship, Model LN-B4, Flyaway, Niles, Michigan, $1,074. Send 15c. for booklet describing the new Heath, the new assembly kit and new, easy purchase plan. Write now for details.

HEATH AIRCRAFT CORPORATION
Dept. A-27, Niles, Mich.

HEATH
AIRCRAFT



AT LAST!

THE BOOK THE FLYING WORLD HAS EAGERLY AWAITED . . .

BLIND FLIGHT
IN
THEORY AND PRACTICE

By Major Wm. C. Ocker
and Lieut. Carl J. Crane

America's Foremost Blind Flight Instructors

110 Illustrations
Over 200 Pages—Size 6x9—

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The book of inestimable value to Pilots, Operators, Flight Surgeons, Instructors, Engineers, Mechanics, Students, Flying Schools, Manufacturers, and Libraries. An essential part of the equipment of everyone interested in flying.

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The Aeroplane, London, England.

Naylor Printing Co., Publishers, 918 N. St. Mary's, San Antonio, Tex.
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You agree to return my money in full if I return books within 5 days.
NOTE: If you enclose remittance with this order, we will pay postage charges. Same return privilege.

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THE HANGAIRLITE PROCESS

SMOG is conquered!

They are the unwanted riders—which so diligently attach themselves to planes while in the air and hangar. Atmospheric condensation combined with dust and smoke create these tiny SMOGS which so hamper performance and spoil appearance.

But SMOG is conquered by *The* HANGAIRLITE *Process* with ease, rapidity and economy.

Developed and perfected after years of chemical research—fitted to the needs of Aviation particularly—tuned to the tempo of the times—Hangairlite comes to you to solve the problems that have long baffled Aviation Engineers—ground problems that have affected air performance.

AERONAUTICAL INDUSTRIES RESEARCH

Dubuque Iowa

Member Aeronautical Chamber of Commerce — **Manufacturer of Progressive Aircraft Finishes**

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By Edward P. Warner, Editor, *Aviation*, formerly Assistant Secretary of the Navy for Aeronautics, formerly Professor of Aeronautics, M.I.T., and S. Paul Johnston, Aeronautical Engineer, Assistant Editor, *Aviation*.

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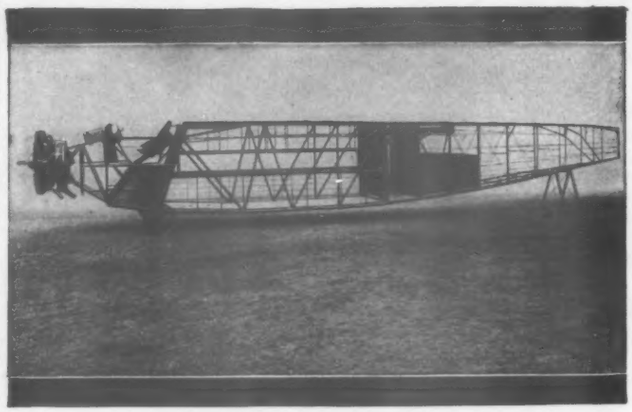

YOU KNOW HOW TO BUILD AIRPLANES

WE KNOW HOW TO MAKE AIRPLANE TUBING

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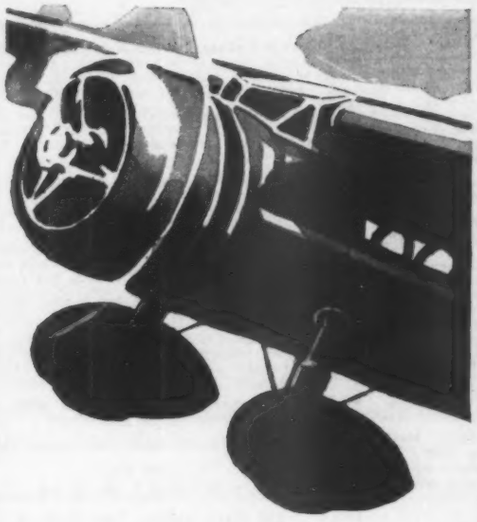

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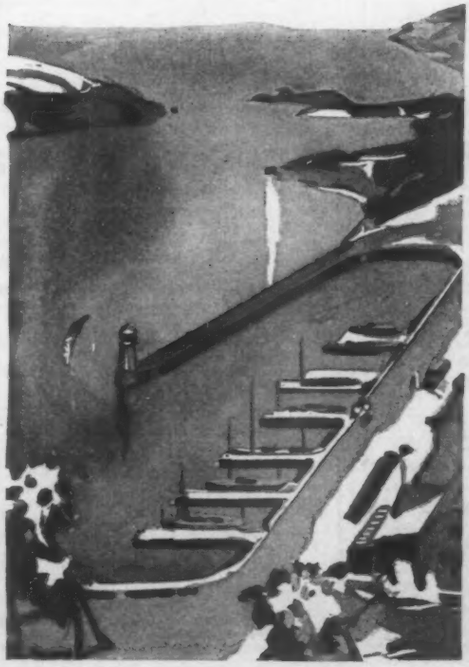

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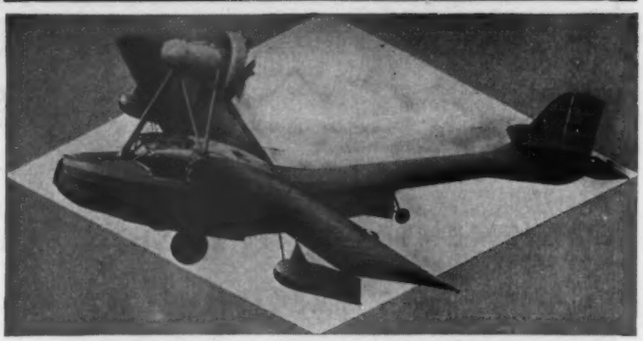

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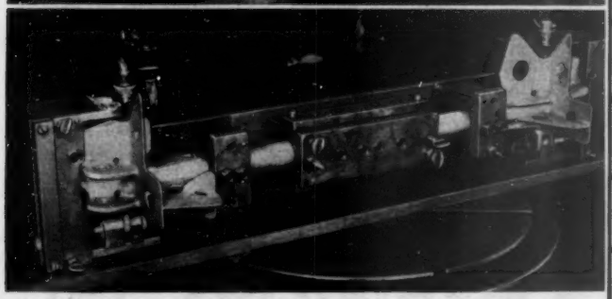
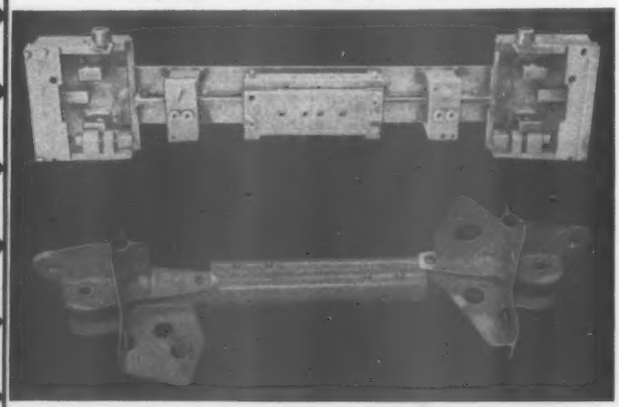


Fuselage bulkhead fitting assembled in drill fixture designed by the Martin Company and constructed in the Martin tool department.

The Martin engineering department is composed of men of extensive technical training, wide experience and highly developed accuracy and skill.

★ ★ ★



The completed fuselage bulkhead fitting. The design of the drill fixture is so accurate that the fittings produced are exact duplicates in every minute detail.

THE GLENN L. MARTIN COMPANY

BUILDERS OF DEPENDABLE AIRCRAFT SINCE 1909

"I would try it again with a WASP"

AMELIA EARHART

So read the cable from Ireland dispatched by Miss Earhart, who is Mrs. George Palmer Putnam at home, after completing the first trans-Atlantic solo flight ever made by a woman, and setting a new record for speed between the two continents. America is proud of the skill and courage with which Miss Earhart justified its enthusiastic confidence. And Pratt & Whitney is proud of the unqualified dependability with which Miss Earhart's Wasp engine earned her frank praise.

International News Photo in circle

This photograph showing the Wasp-powered Lockheed in which Amelia Earhart flew from Harbor Grace to Londonderry was snapped just before the take-off. Acme Photo.

Wasp* & Hornet* Engines

*REGISTERED TRADE-MARK

THE PRATT & WHITNEY AIRCRAFT CO. . . . EAST HARTFORD . . . CONNECTICUT

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Manufactured in Canada by Canadian Pratt & Whitney Aircraft Co., Ltd., Longueuil, P. Q.; in Germany by Bavarian Motor Works, Munich; in Japan by Nakajima Aircraft Works, Tokyo.

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She also relied on

When Amelia Earhart landed in Ireland on May twenty-first, she completed the fastest Atlantic crossing on record; thirteen hours and thirty minutes!

Great credit is due Miss Earhart and her associates for the careful preparation contributing to her brilliant flight. Careful preparation has characterized all successful transatlantic flights, the list of which includes every attempt made using Stanavo products.

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